



The **CRUSHED STONE JOURNAL**

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Excellent Attendance**

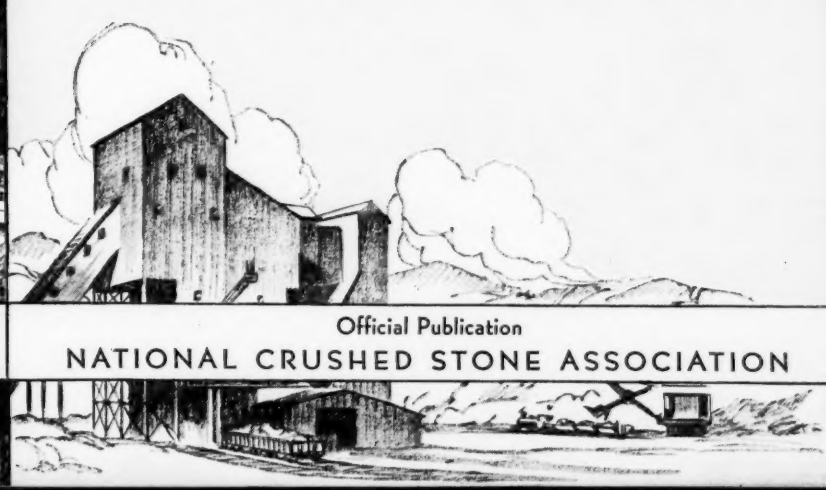
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Official Publication
NATIONAL CRUSHED STONE ASSOCIATION

Technical Publications
of the
National Crushed Stone Association, Inc.



BULLETIN No. 1

The Bulking of Sand and Its Effect on Concrete

BULLETIN No. 2

Low Cost Improvement of Earth Roads with Crushed Stone

BULLETIN No. 3

The Water-Ratio Specification for Concrete and Its Limitations

BULLETIN No. 4

"Retreading" Our Highways

BULLETIN No. 5

**Reprint of "Comparative Tests of Crushed Stone and Gravel Concrete in New Jersey"
with Discussion**

BULLETIN No. 6

The Bituminous Macadam Pavement

BULLETIN No. 7

Investigations in the Proportioning of Concrete for Highways

BULLETIN No. 8

**The Effect of Transportation Methods and Costs on the Crushed Stone, Sand and Gravel,
and Slag Industries**

BULLETIN No. 9

Tests for the Traffic Durability of Bituminous Pavements

BULLETIN No. 10

Stone Sand

Single copies of the above bulletins are available upon request.

The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

NATIONAL CRUSHED
STONE ASSOCIATION



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Washington, D. C.

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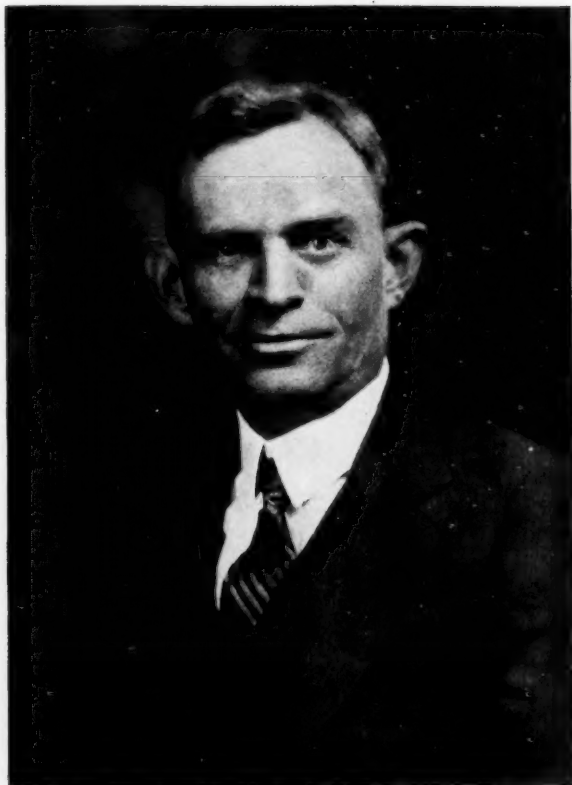
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H. E. RODES

President

Franklin Limestone Company, Nashville, Tennessee

**who was reelected President of the National
Crushed Stone Association at its Twentieth
Annual Convention held in Cincinnati,
Ohio, January 18-19-20, 1937.**

THE CRUSHED STONE JOURNAL

WASHINGTON, D. C.

Vol. XII No. 1

JANUARY-FEBRUARY, 1937

Twentieth Annual Convention Draws Excellent Attendance Program of Exceptional Merit Brings Wide Approval

DELEGATES to the Twentieth Annual Convention of the National Crushed Stone Association, held at the Netherland Plaza Hotel, Cincinnati, Ohio, January 18, 19 and 20, 1937, took home with them the gratifying conviction that the dark days of the depression have been relegated to the past and that the crushed stone industry may confidently look forward to a substantial improvement during the years just ahead. And wishful thinking cannot be assigned as the cause for this conclusion—from the opening of the convention by President Henry Rodas on Monday morning to its climactic conclusion in the Annual Banquet on Wednesday evening, the record is replete with evidence that a new era is dawning for the crushed stone industry.

Production figures showed substantial gains for 1936, in general accompanied by a strengthening of prices. Definite possibilities exist for expansion of crushed stone markets and perhaps most important of all is the realization that, as each year slips by, greater opportunities are afforded for capitalizing on the results of the intensive activities constantly being conducted by the Bureau of Engineering and the research laboratory.

Notwithstanding the fact that prospects for the future seem brighter than for some time in the past, we must not be unmindful that the road ahead is by no means entirely free of obstacles. Develop-

♦ H. E. Rodas Re-elected President; Max Lambert becomes Chairman of Manufacturers' Division; Regional Vice-Presidents report on business conditions; future policies in highway building outlined; production and use of stone sand discussed; medical and legal aspects of silicosis problem reviewed; policy adopted regarding Federal legislation; labor relations receive important consideration; opportunities for market expansion described; Manufacturers' Division Exposition receives unusual attention.

ments of far-reaching importance may be expected in the field of labor relations. Silicosis must receive our constant attention. And the growing complexities of the relation between Government and business will constitute a challenge to our best efforts. But even these more unpleasant aspects of the future need not cause us undue concern as solutions can certainly be found for such difficulties if we approach them with sincerity and intelligence and in the spirit of cooperative effort. A further and highly significant indication that we are definitely on the upgrade is reflected in the attendance figures at Cincinnati where between 350 and 400 delegates were officially registered. And, as the convention progressed, it was gratifying to note the intense interest manifested by those present in the subjects on the program. Not in our memory have convention sessions been so well attended, nor have so many participated in the general discussions.

In what follows we shall endeavor to cover the highlights of the meeting—largely for the benefit of those who found it impossible to be present. Also, in this issue of the *Journal* and subsequent ones effort will be made as space permits, to publish all of the more important papers presented at the convention.

All members of the Association will share the enthusiasm of those present at Cincinnati in learning that at the business session held on Wednesday afternoon Henry Rodes, President of the Franklin Limestone Company of Nashville, Tennessee, was unanimously reelected President of the Association for the ensuing year. Because of his intense interest in Association affairs and constant and generous willingness to assist in every possible way, the Association is indeed fortunate in having him for its President for another year. With the exception of two vacancies occurring on the Board of Directors during the past year, all officers and directors were reelected for the coming year. Mr. Daniel Sanborn, Lehigh Stone Co., Kankakee, Illinois, and Mr. W. C. Sparks, Cedar Bluff Quarry, Princeton, Kentucky, were elected to fill these vacancies. In accord with action taken at the St. Louis Convention in 1936, it

became the duty of the newly elected Board of Directors to elect an Executive Committee for the year. Consequently, the new Board, at its first meeting held immediately following the convention, elected the following to the Executive Committee: H. E. Rodes, *Chairman*; E. Eikel, Otho M. Graves, E. J. Krause, Russell Rarey, Stirling Tomkins, T. I. Weston, A. L. Worthen.



MAX LAMBERT
Elected Chairman of
Manufacturers' Division

The Manufacturers' Division of the Association, in selecting its chairman for the coming year, made a choice which is certain to prove popular, not only among the members of the Division, but also among the active membership. Max Lambert, Robins Conveying Belt Co., Chicago, Illinois, was accorded this honor. Mr. Lambert is a regular attendant at our annual conventions and enjoys a well deserved popularity throughout the industry. Under his capable leadership, the Manufacturers' Division will undoubtedly be markedly

strengthened during the coming year. The Division elected the following vice-chairmen and directors at its annual meeting held during the convention period. Vice-Chairmen: Bradley S. Carr, J. Harper Fulkerson, H. A. Johann, Frank B. Ungar, Roy Wills. Board of Directors: M. S. Lambert, *Chairman*, Robins Conveying Belt Co., Chicago, Illinois; J. Barab, Hercules Powder Co., Wilmington, Del.; Bradley S. Carr, American Manganese Steel Co., Chicago Heights, Ill.; F. E. Finch, Hardinge Co., York, Pa.; J. Harper Fulkerson, Cross Engineering Co., Carbondale, Pa.; H. T. Gracely, Marion Steam Shovel Co., Marion, Ohio; C. S. Huntington, Link-Belt Co., Chicago, Ill.; Kenneth Jensen, Kensington Steel Co., Chicago, Illinois; H. A. Johann, Frog, Switch & Mfg. Co., St. Louis, Mo.; L. B. McKnight, Chain Belt Co., Milwaukee, Wis.; Albert E. Reed, The W. S. Tyler Co., Cleveland, Ohio; S. R. Russell, E. I. Du Pont De Nemours & Co., Wilmington, Del.; Bruce G. Shotton, Hendrick Mfg. Co., Pittsburgh, Pa.; L. W. Shugg, General Electric Co., Schenectady, N. Y.; C. W. Swanson, Illinois Powder Mfg. Co., St. Louis, Mo.; John Swenehart, Atlas Powder Co., Wilmington, Del.; P. C. Tennant, The Texas Co., New York City; S. W. Traylor, Traylor Eng. & Mfg. Co., Allentown, Pa.; Frank B. Ungar, Ludlow-Saylor Wire Co., St. Louis, Mo.; Roy Wills, Lima Locomotive Co., Lima, Ohio; F. O. Wyse, Bucyrus-Erie Co., South Milwaukee, Wis.

Regional Vice-Presidents Report on Business Conditions

Immediately following the opening of the convention on Monday morning and in accord with a practice which has been continued for many years because of its popularity and interest, the regional vice-presidents of the Association submitted reports with regard to business conditions during 1936 and the prospects for 1937, in their respective territories. It was gratifying to learn from these reports that definite improvement has been experienced generally throughout the industry in 1936, with indications that conditions during 1937 will at least equal and in many instances probably exceed the gains of the year just concluded.

T. I. Weston, reporting for the Southern Region, indicated that volume during 1936 had increased from 20 to 89 per cent, with the price level maintained and in some cases showing an increase as high as 20 per cent. However, only some 60 per cent of present plant capacity was utilized. Mr. Weston

stated that from 60 to 75 per cent of shipments were made for highway construction and maintenance, 10 to 20 per cent for railroad ballast, approximately 10 per cent for building construction and the remainder for agricultural limestone and miscellaneous uses. Business conditions in this territory during 1937 should be fully as good and possibly better, with essentially the same distribution of tonnage as prevailed in 1936. It is anticipated that prices should remain firm and possibly improve during the coming year in some sections. Governmental operation of crushed stone plants has not proved a serious menace throughout the region, according to Mr. Weston, although in certain sections of Tennessee such competition has been felt keenly. In Georgia and South Carolina the tonnage lost to portable plants has not been large in comparison to total volume, but in North Carolina and Tennessee such tonnage is increasing.

Reporting for the Northern Region, N. E. Kelb stated that 1936 recorded a definite gain as contrasted to the previous year, although the improvement was more evident as to tonnage than as to price. He estimated that the increase in tonnage amounted on the average to about 35 per cent and, taking the region as a whole, demand approximated 50 per cent of capacity. Mr. Kelb laid especial emphasis on the substantial increase in production of agricultural limestone in the State of Illinois, stating that this tonnage in 1936 exceeded 1,000,000 tons, whereas in 1932 the comparable total was approximately 133,000 tons and in 1935, 523,000 tons. Competition from Governmentally operated plants does not appear to be increasing and in the southern portion of the region competition from portable plants is not so serious as has been the case in previous years. Mr. Kelb pointed out that it is encouraging to note in his region a lessening in the demand for reduced gasoline taxes and the crystallization of opinion that efforts should be devoted to halting the diversion of gasoline taxes. The outlook at the present time appears promising during 1937 for the heavy industries. This, he interprets, will mean an increase in chemical and metallurgical stone and an increase in railroad traffic, which, in turn, should stimulate ballast business. The necessity for securing higher prices, in order to meet mounting costs, is being realized by producers. Mr. Kelb estimates that the total tonnage for 1937 should exceed the figures for 1936 by from 15 to 25 per cent and that an increase in selling prices may be expected.

Supplementing the report of Mr. Kelb for the Northern Region, Mr. Nauman gave some interesting observations which he confined to the State of Iowa. Mr. Nauman stated that, with the price levels slightly increased over 1935, 50 per cent of the material shipped was used in highway construction, 35 per cent in building construction and 25 per cent as agricultural limestone. Production in the State approximated 25 per cent of the total capacity. In Iowa, producers have experienced considerable competition from WPA. In one instance, Mr. Nauman pointed out, a county produced 15,000 cubic yards of stone for a single project, using its own equipment, operated by WPA labor.

Reporting for the Central Region, J. A. Rigg stated that 1936 recorded an increased tonnage as compared to 1935 which, though not large, was definitely encouraging. Price levels for 1936 showed no substantial variance compared to conditions during the preceding year, with the general agreement throughout the Region, however, that the price trend during 1937 should be definitely higher in order to keep step with increasing costs. Demand last year, approximating 40 per cent of plant capacity, was classified as follows: Highway construction and maintenance, 40 per cent; railroad ballast, 20 per cent; building construction, 10 per cent; metallurgical and other purposes, 30 per cent. The demand during 1937 should be at least as good as in 1936. In view of the fact that ballast requirements in the Region have become practically stabilized, no large increase in ballast tonnage can reasonably be expected. Labor difficulties now confronting the automobile and steel industries, it was pointed out, may seriously curtail the demand for chemical and metallurgical stone. With the elimination of these difficulties, however, a substantial increase in the demand for this class of tonnage should be experienced. The Federal Agricultural Conservation Program should result in a definite increase in the demand for agricultural limestone. Competition from Governmentally owned plants is not a serious menace in this Region, though the tendency in at least one State to produce agricultural limestone in a State-owned plant by the use of convict labor is noted with some anxiety. The feeling generally prevails that while the WPA has not directly harmed the business of private producers, Governmentally-operated projects of this character constitute a potential danger which can only be averted by constant vigilance on the part of members of the industry. Mr. Rigg closed his report with this significant observation: "The overwhelming ap-

proval of the present Administration in the recent national election leaves no conclusion but that its policy of exploration and experimentation along many lines will be continued. Therefore, it behooves us all to enthusiastically support our National Association in every phase of its work in order that we may be in a position to render united and intelligent support to such proposals, governmental and otherwise, as may be beneficial to our industry and the Country at large, and in the same manner oppose such proposals as we deem fallacious, and the results of which we believe work injury to our industry and the Country."

In reporting for the Southwestern Region, E. Eikel stated that 1936 showed an increase in production as compared to 1935, with prices remaining at substantially the 1935 level and demand approximating 33-1/3 per cent of total available plant capacity. Highway construction absorbed 65 per cent of the 1936 tonnage; railroad ballast 15 per cent, building construction, 10 per cent; chemical and metallurgical uses, 8 per cent; agricultural limestone, 1 per cent; and other uses, 1 per cent.

It is anticipated that the demand for 1937 will be about equal to that of 1936 with prices trending slightly downward. Highway construction tonnage, it is believed, will decrease, probably compensated for, however, by an increase in railroad ballast. An increase, rather than a decrease, is expected in Governmentally operated plants, the output of which during 1936 caused the industry to lose volume of which it could ill afford to be deprived, with the consequent effect of increasing unit cost and lessening employment. An increase in the use of portable plants is anticipated, though, to date, established producers have not used portable equipment to any great extent to supplement stationary plant capacity. The WPA program, while creating business for some commercial plants, has probably increased production from Governmentally operated plants by as much as 25 per cent. Mr. Eikel pointed out the great need for a downward revision of the general freight rate structure on the products of our industry, observing that point to point rates have been reduced in many instances, but standard scale mileage rates remain at levels higher than much of the traffic can bear. In conclusion, Mr. Eikel stated that members in the Southwestern Region have in many instances received valuable assistance from information made available by the Bureau of Engineering and that such activities should be expanded if ways and means can possibly be found to do so.

Finding it impossible to be present at the convention, Porter W. Yett reported for the Northwestern Region by letter. He stated that production for 1936 exceeded that of 1935 by approximately 20 per cent, and that the 1936 price level, notwithstanding increased production costs, was about the same as that for 1935, and that the volume for the year was approximately 35 to 40 per cent of production capacity. Tonnage classification for the Northwestern Region was reported as follows: Highway construction and maintenance, 60 per cent; railroad ballast, 5 per cent; building construction, 5 per cent; agricultural limestone, 10 per cent; jetty and revetment stone for flood control and bank erosion, 20 per cent. An increase in both volume and price for 1937 is anticipated. Portable plants are fast replacing stationary plants and the trend in this direction in the future is expected to continue. The WPA program has definitely increased the Governmental production of our materials and should continue to be vigorously opposed by the Association. Expansion of the work of the Bureau of Engineering is recommended, with specific regard to affording members assistance in connection with the modernization of plants required in view of the more exacting specifications resulting from technical research.

The convention learned with very real regret that, because of serious illness, Mr. Arthur S. Lane, Regional Vice-President for the Eastern Region, was unable to attend and submit a report for that territory. Mr. Lane's annual reports have been anticipated with very real interest because of the obvious trouble which he invariably takes to submit a comprehensive and accurate report of conditions existing in his territory. It was also noted with disappointment that reports for the Canadian Region and Western Region were not available.

Reports of Administrative Directors

Following the reports of the Regional Vice-Presidents, A. T. Goldbeck, Engineering Director of the Association, presented a paper entitled, "Needful Research in the Use of Aggregates." Mr. Goldbeck's paper is of such fundamental importance to the crushed stone industry that it is reprinted in full elsewhere in this issue. It well warrants a careful study by all engaged in the production of crushed stone.

Following Mr. Goldbeck, the report of J. R. Boyd, Administrative Director was presented. Mr. Boyd reviewed the financial emergency existing at the close of 1935 and stated that through the whole-

hearted cooperation of the membership, the Association had been able to complete the year 1936, after all bills were paid, with a slight cash surplus on hand. He outlined briefly the plan approved early last year by the Executive Committee for rebuilding the Association, reporting the progress which had been made under that plan. Increasing the effectiveness of Association service to its membership, through both its Administrative and its Engineering functions is anticipated during the coming year through the whole-hearted and continued generous support of Association activities by member companies. Detailed reports concerning the activities of their respective departments, submitted to the meeting of the Board of Directors which took place immediately preceding the convention, it is contemplated will subsequently be distributed to the membership for its information. Consequently, it is deemed unnecessary to give a more comprehensive report concerning these matters at this time.

Awards for N. C. S. A. Safety Contest Presented

Presentation of the safety awards for the National Crushed Stone Association Contest for 1935 took place on Wednesday morning. Mr. W. W. Adams, Supervising Statistician, Employment Statistics Division, U. S. Bureau of Mines, had been designated by the Director of the Bureau—in view of the fact that he, himself, could not be with us because of the Inaugural ceremonies in Washington—to present the awards. Mr. Adams is well known throughout the crushed stone industry for his intense interest in safety work and also because it is under his immediate supervision that the accident statistics for our industry are collected and analyzed. It was, therefore, a deep disappointment to us to learn that Mr. Adams was ill and consequently would not be in Cincinnati to present the safety awards. Mr. A. U. Miller of the Vincennes, Indiana, office of the Bureau of Mines, was designated to act in Mr. Adams' place, and we are much indebted to the Bureau for sending such an able substitute. In presenting *The Explosives Engineer Award* to the Columbia, Illinois, plant of the Columbia Quarry Company, Mr. Miller pointed out that this quarry had operated during the years 1933, 1934, 1935, and 1936—a four-year period—without a lost-time accident, representing a total man-hours of exposure of over 700,000. In the contest for 1935, 46 plants were entered, 19 of which worked the entire year without a lost-time accident. In stating that approximately 40 per cent of the

plants entered in the Contest completed the year with no lost-time accidents, Mr. Miller observed that this was an unusual record in accident prevention and one of which the Association and each of its members might well be proud. In the field of accident prevention the Bureau of Mines has contact with many industries and Mr. Miller pointed out that experience has proven beyond a doubt that safety work is a paying proposition, that instead of reducing production and increasing cost, it reduces the cost and increases the efficiency. Mr. Elmer Heise received the safety award for first place in the contest in behalf of the Columbia Quarry Co. and, with brief remarks appropriate to the occasion, said that in the experience of his organization safety work definitely had paid.

Following the presentation of the award to the winner, Mr. Miller presented to each of the following plants a parchment reproduction of *The Explosives Engineer* plaque, awarded for honorable mention in the Contest.

American Limestone Co.	Man-Hours
Holston limestone quarry, Mascot, Tennessee	122,934
Marquette Cement Mfg. Co.	
Cape Girardeau limestone quarry, Cape Girardeau, Mo.	111,928
New Haven Trap Rock Co.	
North Branford trap rock quarry No. 7, North Branford, Conn.	95,061
Middlefield No. 1 trap rock quarry, near Middlefield, Conn.	52,575
Plainville No. 4 trap rock quarry, Plainville, Conn.	45,079
Rocky Hill No. 3 quarry, Rocky Hill, Conn.	15,374
Ohio Marble Co.	
Piqua limestone quarry, Piqua, Ohio	87,370
North American Cement Corp.	
Berkeley Nos. 5 & 6 limestone quarry, Martinsburg, W. Va.	84,396
Security limestone quarry, Security, Md.	75,967
Catskill limestone quarry, Alsen, N. Y.	39,277
J. E. Baker Co.	
Blue Mount serpentine quarry, White Hall, Md.	69,811
Union limestone quarry, Mt. Wolf, Pa.	53,487
Thomasville quarry, Thomasville, Pa.	46,626
Pembroke Limestone Corp.	
Pembroke limestone quarry, Pembroke, Va.	57,982
General Crushed Stone Co.	
White Haven limestone quarry, White Haven, Pa.	57,012

American Lime and Stone Co.	
Union Furnace limestone quarry, near Tyrone, Pa.	47,278
Wickwire Spencer Steel Co.	
Gasport limestone quarry, Gasport, N. Y.	42,491
Tennessee Cement and Lime Co.	
Summitville limestone quarry, Sum- mitville, Tenn.	20,132

Relations of Government and Business

The increasing complexities of the relations between Government and business constituted an important phase of the convention program. The observations made by a number of speakers, exceptionally well qualified to discuss this subject, clearly indicated that no longer can the business man only "tend strictly to business." He must give consideration to the important political and social problems involving the general welfare of the country. The Greeting Luncheon on Monday was privileged to hear the Honorable Charles Sawyer, former lieutenant-governor of Ohio, and for a number of years prominently identified with the legal, industrial, and political life of the State, discuss "Problems of Present-Day Business." Mr. Sawyer's talk proved of exceptional interest particularly for the practical suggestions it contained for business men. Mr. Sawyer emphasized two points in the course of his remarks: First, that business men must take a more active interest in the affairs of Government; and second, more serious consideration than in most cases has existed in the past must be given to the question of labor relations. Speaking to the first point, he declared that, in view of the fact that Government is coming to take more and more of a part in supervising activities, it would seem that the sensible thing for business men to do is not to bemoan a situation which is apparently inevitable, but to accept it as a fact and then decide what they as business men and citizens can do about it. And that the thing to do about it is to take more of an interest in Government. We must see that the man in public office who wants himself reelected takes as his method of accomplishing that purpose the policy of rendering the best kind of service to the public on the theory that this is the thing that will get him reelected. Mr. Sawyer feels that the problem must be approached first from our own personal standpoint as an advantage to us, no matter what our business may be, to see that we have the highest kind of public officials, but, also, it must be approached from the standpoint of citizenship, for,

as citizens, we are all interested in seeing that we have a high type of public official. Such observations apply with equal force to county officials, state officials, and Federal officials. Provided it is not attempted unworthily, Mr. Sawyer feels that business executives, if they are smart enough and wise enough, can control public opinion to a far greater extent than almost any other group. As his second point, Mr. Sawyer urged that business men become better acquainted with the problems of labor. He declared his emphatic belief in a capitalistic system as being the only system which will really work and that a more sympathetic understanding of the problems of labor will do much to accelerate the business recovery now in progress.

Speaking on the same theme, Whiting Williams, nationally known industrial consultant and adviser, gave one of the outstanding talks of the convention in his address entitled, "What's on the Worker's Mind Today?" The subject matter of Mr. Williams' remarks are of such timely interest and value that his paper is being reprinted as a separate document and will shortly be mailed to all members of the Association. We cannot too strongly urge that it be given a most careful study, as the observations made by Mr. Williams are based upon years of experience, and his practical suggestions can do much to eliminate labor difficulties.

Legislation

Conscious of the growing responsibility of business to declare itself on matters which vitally concern it, President Rodes, substantially in advance of the convention, appointed a Resolutions Committee whose task it was to consider such Federal legislation—either existing or proposed—as directly affects the crushed stone industry and to express the opinion and declare the attitude of our industry towards such legislation. The Committee which included Mr. Otho M. Graves as Chairman and Messrs. Krause, Weston, Rarey, Williams, Eikel, Worthen, Prince, and Tomkins, met in Cincinnati for two days prior to the opening of the convention. After devoting many hours of arduous labor to the task assigned, a report was finally drafted, printed and submitted to the convention on Wednesday afternoon for approval, modification, or rejection. In presenting the report of the Committee to the convention for action, Mr. Graves made the following observations:

"I want to say, on behalf of the Resolutions Committee, that it approached its task in that serious,

earnest manner which I have observed to be constantly characteristic of any committee of this Association. The Committee is also of the opinion, which doubtless you will share, that we cannot expect materially to affect the course of legislation by any printed expression of our opinion concerning it. We do believe, however, that it is the duty of every citizen, every industry and all industry combined to forcefully express its opinion on all matters concerning the welfare of industry, because if it does concern the welfare of the industry it concerns the welfare of every person in the United States. Otherwise, it is too much like saying, 'There is no use in our doing it,' as one says, 'There is no need of my voting because everybody knows how my county or state will go in this election.' If everybody does that the electorate system fails.

"From that standpoint I like to think of this Association adopting resolutions which do express the general crystallized opinion of the entire industry, and to join those resolutions with those of other like associations and with the association which comprises other industries, the National Association of Manufacturers, so that there is a united industrial front presented in Washington concerning the legislation involved. It is from that standpoint largely that your Committee feels that such a report adopted by you does have its values."

Mr. Graves then outlined to the convention the high points of the report, following which it was unanimously adopted. With the first session of the Seventy-Fifth Congress just getting under way, this report becomes a valuable and timely document, reflecting, as it does, the attitude of the crushed stone industry on the issues of vital significance to our industry which will come before the present Congress. The full text of the report of the Resolutions Committee will shortly be mailed to the membership and many ways will undoubtedly suggest themselves to individual members to utilize this report to the best advantage. It will also be brought to the attention of appropriate Congressional committees and other interested parties by the Association.

A most interesting discussion was presented on Wednesday afternoon by John C. Gall, Associate Counsel of the National Association of Manufacturers, under the heading, "Outlook for Federal Legislation Affecting Industry". Mr. Gall drew an excellent picture of the present legislative situation,

with particular reference to measures under consideration of specific concern to the crushed stone industry. Mr. Gall is one of the best qualified men in the country to speak on the subject of legislation and his observations, printed elsewhere in this issue, should command the interested attention of every producer.

Future Markets

Highway construction and railroad ballast constitute two of the most important markets for crushed stone. Consequently, the paper presented by W. C. Markham, Executive Secretary of the American Association of State Highway Officials, entitled, "Future Policies in State and Federal Road Building", and the discussion by M. J. Gormley, Executive Assistant to the President, Association of American Railroads, entitled, "Railroad Progress", proved of absorbing interest.

Mr. Markham gave an excellent analysis of the future highway building program, pointing out that in his opinion there never will be such a thing as a road building holiday. Curtailment in road construction means increased expenditure for maintenance, not only for the highways, but also for the vehicles which use the highways. A well ordered, continuous, planned road program, thoroughly substantiated by economic demand, should be accepted by all those in authority as the only business-like policy. Unfortunately, space does not permit the publication of Mr. Markham's article in this issue of the *Journal*, but we are planning to give its full text in the following one.

Mr. Gormley outlined the many ways in which the railroads have improved their service during recent years and particularly urged that legislation affecting the railroads which greatly adds to their expenses without adding anything to their efficiency or safety in operation should be prevented. He pointed out that there was spent for ballast in 1930, \$11,455,000 which dropped in 1933 to \$1,999,000 and increased in 1935 to \$3,227,000, the figures for 1936 not yet being available. The charges to operating expenses for maintenance of ballast, including labor charges, were \$13,261,752 in 1930, dropping to \$4,959,000 in 1932 and increasing again to \$8,356,813 in 1935. Mr. Gormley's discussion concerning the railroad situation was most illuminating and because of the close relationship existing between the railroads and the crushed stone industry should receive our close attention when printed in a subsequent issue of the *Journal*.

Low Cost Roads Offer Excellent Outlet for Crushed Stone

Of exceptional interest to crushed stone producers were two papers presented on Wednesday morning dealing with the subject of stabilized roads. C. L. McKesson, Vice-President, American Bitumuls Co., had prepared a paper for presentation entitled, "Stabilizing Quarry Fines for Base Construction". Because of Mr. McKesson's ill health and consequent inability to be present, the paper was presented by Charles P. Jones, of the Baltimore office of that company. Following Mr. Jones, R. A. Giddings Secretary of the Calcium Chloride Association, discussed this subject under the heading, "Low Cost Roads Will Multiply Stone Markets". Judging from the observations made by these gentlemen and supplemented by our Engineering Director, Mr. Goldbeck, the use of quarry fines for stabilizing low cost roads offers to crushed stone producers a most attractive and profitable market. Mr. Goldbeck, in his discussion on the first day of the convention, stated that crushed stone producers must find their place in this stabilized road program and that this should not be difficult because crushed stone possesses excellent properties for creating a stabilized surface. His opinion in this regard is adequately supported by both Mr. McKesson and Mr. Giddings, the former discussing stabilization methods through the use of emulsified asphalts and the latter by means of calcium chloride. When it is realized that about two out of every three miles of our highways are unimproved and that for every mile of pavement there are twenty-five miles of side roads, most of which are sadly inadequate to traffic requirements, a better appreciation of this potential market is realized. Also, a further factor, by no means without significance in this situation, is the allocation in Federal aid appropriations for 1938 of \$25,000,000, or 1/5 of the total of Federal-aid for highways, for secondary or feeder roads. The contributions of Mr. McKesson and Mr. Giddings constitute such a valuable contribution relative to future crushed stone markets that they will be subsequently printed in *The Crushed Stone Journal* in full text.

Production and Use of Stone Sand

One of the outstanding developments of the past year was the increased interest manifested by crushed stone producers in stone sand, largely stimulated by the publication of the Association's En-

gineering Bulletin on this subject. The convention program, therefore, could hardly have been considered complete without a full discussion of this popular subject.

Mr. R. R. Litehiser, Chief Engineer, Bureau of Tests, Department of Highways, Columbus, Ohio, gave us a particularly illuminating discussion of the development of the use of stone sand in the State of Ohio, and to Mr. Joseph H. Jackson, Carbon Limestone Co., Youngstown, Ohio, and Mr. J. A. Rigg, Acme Limestone Co., Ft. Spring, W. Va., we owe a debt of thanks for their able exposition of the practical considerations involved in the production of this product. Highway engineers and producers alike will find the discussions on this subject of real interest and value and though space precludes their publication in this issue of the *Journal* they will shortly be made available.

Silicosis

With some forty state legislatures in session throughout the country during the current year and with the assurance that legislative proposals concerning occupational diseases will be submitted before many of them, the discussions on silicosis, presented at Cincinnati by Dr. R. R. Sayers, Medical Officer in Charge of Industrial Hygiene, U. S. Public Health Service, Washington, D. C., and Theodore C. Waters, Mullikin, Stockbridge and Waters, Baltimore, Md., take on a new significance. Dr. Sayers, in his paper entitled, "Silicosis—What it is and How to Prevent it" devoted himself largely to outlining the causes of the disease and the means by which it is identified, concluding with some important observations concerning its control.

Mr. Waters speaking on the "Legal Aspects of the Silicosis Problem," reviewed the legal relationship of employer and employee and the liabilities imposed upon the employer for the protection of the health of his employees. In both his discussion and that of Dr. Sayers valuable information is contained for producers who face possible litigation in the silicosis field, as well as for those located in states contemplating the passage of legislation on this subject. No further detail concerning their discussions will be given at this time, as Mr. Waters' paper is included in this issue and Dr. Sayers' discussion will be made available to the membership later.

Use of Agricultural Limestone in Federal Conservation Program for 1937

Of particular interest to producers of agricultural limestone was the paper presented by Joseph F. Cox, Senior Agronomist, Division of Program Planning, Agricultural Adjustment Administration, on the subject, "The Use of Agricultural Limestone in the Federal Agricultural Conservation Program for 1937." The operation of this program during 1936 very markedly stimulated sales of agricultural limestone and with the continuation of the program during 1937, new records should be established for the use of this material by farmers. Mr. Cox gave us an excellent picture of the reasons for the establishment of the program. At the time of the Cincinnati Convention the schedules covering Federal payments to farmers for using agricultural limestone during the current year were not available. They have now been completed and form a valuable addition to the remarks which Mr. Cox made at Cincinnati. The full text of his address, supplemented by these schedules for all sections of the United States, have been incorporated in a pamphlet and will immediately be mailed to the entire membership. We are confident that this information will prove valuable in the hands of dealers and salesmen.

Manufacturers' Division Exposition

As was to be expected, the Manufacturers' Division Exposition again proved to be one of the outstanding features of the convention. From the formal opening on Monday evening—preceded by a most enjoyable reception—it was exceptionally well attended until its close on Wednesday afternoon. Much of the success of the Exposition was due to the expert handling of this affair by L. W. Shugg, Director of Exhibits. We take this opportunity of extending to Mr. Shugg sincere appreciation of the Manufacturers' Division and of the Association at large.

Entertainment Features Prove Popular

Judging from the enthusiastic reports received during the meeting and since our return to Washington, the entertainment features of the Cincinnati meeting proved unusually popular and afforded a most pleasurable and appropriate background to the serious side of the meeting. In view of the enthusiastic approval accorded the Convention Cabaret, held

on Tuesday evening, an event of this character will certainly be looked forward to at future conventions. Featured by a floor show far above the average—judging from the whole-hearted applause accorded each act—the show was interrupted during two intermissions for dancing and following the show dancing was continued by popular request until well after midnight.

On Wednesday evening the Association's Twentieth Annual Banquet was held, with President Henry Rodes acting as Toastmaster. Charles P. Taft, son of the late ex-President Taft, was the guest speaker of the evening. Mr. Taft chose for his subject, "New Horizons for America," pointing out that as a result of changing conditions Governmental responsibility—municipal, county, State and Federal—is inevitably going to increase and that arbitrarily to resist such change is not the answer, but rather to give our best thought to each problem as it arises and, in view of the existing circumstances. He called attention to the increase in our social responsibilities, the growing need for conservation of natural resources, and the compelling necessity that business men give more attention and study to a solution of such problems. We were indeed honored to have so distinguished a citizen as Mr. Taft address our banquet and also owe a debt of gratitude to Mr. Wilson P. Foss of the New York Trap Rock Corp., through whose good offices Mr. Taft was obtained.

Immediately preceding the Annual Banquet a Presidential Reception took place in the Headquarters Suite which had been tastefully decorated for the occasion. Commanding unusual attention was the unique centerpiece display in ice of the initials, N C S A, with small electric bulbs artfully placed in the interior of each letter. All present at the convention were invited to attend this affair and it proved to be one of the most enjoyable social events on the program.

In conclusion let us say that the unqualified success of the Cincinnati meeting is certainly not without significance, as it clearly shows a crushed stone industry more united than for many years in the past and facing forward with a real and sincere conviction that the future holds much promise which can best be realized through a continuance of cooperative effort as exemplified in the activities of the National Association.

Needful Research in the Use of Aggregates¹

By A. T. GOLDBECK

Engineering Director,
National Crushed Stone Association

Introduction

ANUALLY, the work accomplished by the Engineering Division of the Association has been brought before the members in the form of a brief digest covering our various activities, presented initially to the Board of Directors and then to the membership as a whole. The results of many of our investigations have also been described in considerable detail before our annual meetings. Today it is not my purpose to report to you on what has been done during the past year for you will have an opportunity to review, at your leisure, my annual report to the Board of Directors on that subject.

We are on the threshold of what promises to be a year of great activity in the construction industry. Many uses are open to our product, some of them firmly established by years of eminently satisfactory service, others of comparatively recent origin while still others remain to be developed. These various uses of aggregates, both old and new, are continuously bringing to light technical problems which are in need of a more satisfactory solution than exists today. In some cases the selection of one kind of aggregate as against another will be governed by the facts which are brought forth by research. Test limits for comparatively new tests will soon be written into specifications and if these limits are ill-chosen and not based on facts, injustices will result and loss of many sales of crushed stone will ensue.

Engineers continue to accept test methods whose value as indicators of the relative quality of aggregates seem not so firmly established as was apparently the case when the tests were first applied. Old tests for the quality of aggregates and of concrete continue to be used year after year in spite of growing doubt as to their real significance as indicators of service value. New methods of construction are developing such as in the case of the stabilized road, including both foundation and wearing surface.

♦ There are problems of a technical nature confronting crushed stone producers today the solution of which has extraordinary significance to our industry. Some of the more important of these problems are discussed by Mr. Goldbeck in the following article and many will be the subject of investigation in the Association's research laboratory during the coming year. Information as to additional problems and suggestions as to which are the most pressing will be welcomed by the Bureau of Engineering.

How does crushed stone best fit into this type of construction? But perhaps I have said enough to indicate to you in a preliminary way that there are problems of a technical nature confronting us whose solution has extraordinary significance to our industry.

It is my purpose to discuss some of these problems which have been brought to my attention and it is my hope that through discussion or through subsequent correspondence you will inform me of additional problems which are particularly urgent. Thus shall we be able to direct our investigational efforts in those fields which are of highest importance to the crushed stone industry.

Let us proceed to examine in a systematic and orderly manner a few of the important problems.

1. Concrete

(a) *Concrete Pavements.* In connection with the use of aggregates in concrete highways several points need investigation. A number of years ago engineers were accustomed to think of the quality of concrete in terms of its compressive strength alone. When a crack forms in a concrete highway, this crack results, not from lack of compressive strength in the concrete, but rather through its lack of resistance to tension.

Concrete pavement slabs are in reality beams of great width in comparison with their depth. They bend under passing vehicles; under the action of variations in temperature which are continuously taking place; they are warped by changes in moisture content extending from top to bottom of the slab and, furthermore, the condition of subgrade support is practically never constant. In fact, each vehicle tends to form a minor rut in the subgrade which, al-

¹ Presented at the Twentieth Annual Convention of the National Crushed Stone Association, at Cincinnati, Ohio, January 18-20, 1937.

though invisible, is readily detected by the measurement of subgrade pressures before and after the passing of the wheel load. Bending cannot take place without creating internal stress and, according to the principles of the mechanics of beams, tensile stresses as well as compressive stresses are produced by this bending action. Roughly, concrete is only one-seventh as strong in tension as in compression and consequently when failure of the beam takes place, that failure is one of tension and not of compression.

Many years of intense investigational work, involving the measurement of stresses in concrete pavements were necessary to establish the present beam theory of design. Finally, as the result of much effort on the part of several research agencies including our own Association, the method of testing concrete for highways by the use of the beam test was standardized and today it is undoubtedly the most indicative test we have for determining the quality of concrete for pavements. However, the speaker is unwilling to accept this test, or at least its interpretation as the ultimate and all-conclusive test for highway concrete, for there are too many instances on record in which, notwithstanding relatively minor differences in beam strength, very great differences are being developed in the amount of cracking taking place in concrete roads containing different aggregates. It is not unfair to say that, by and large, crushed stone concrete pavements are showing a minimum of cracking in comparison with concrete made with other aggregates. There are exceptions to this general statement and unquestionably other aggregates at times have given better results than some crushed stones, but I believe that to be the exception. One need only ride over a representative mileage of concrete highways and I think he will be convinced that generally crushed stone is giving superior results.¹

The amount of cracking in crushed stone concrete is sometimes only half that of gravel concrete subjected to similar conditions, in spite of only minor differences in modulus of rupture or in fact with reversed values for beam strength as was the case in the Ohio Post Road reported in the June, 1925 issue of *Public Roads*. The gravel concrete in that road, probably because of a higher cement content, showed somewhat higher beam strength than the crushed stone concrete and yet there was roughly twice as much cracking in the gravel sections as in

the stone sections. We are led to the suspicion, at least, that although the beam test is our best measure today of the quality of highway concrete, by no means should we be satisfied with it but should look further for a real measure of the reason for the differences in quality of different concretes.

When a beam test is made the beam is handled very carefully under standard curing conditions. It is mounted in the testing machine with great care and load is applied slowly only once up to the point of failure. The concrete in a highway, on the other hand, is immediately subjected to shrinkage effects from the drying out of moisture. It is expanded and contracted by temperature changes and when it is thrown open to traffic, passing wheel loads produce internal stress, thousands and perhaps hundreds of thousands of times before a load finally comes along which produces sufficient over-stress to crack the concrete. Does it not seem reasonable to believe that this pre-stressing which takes place in the road, not once, but many times might affect in a dissimilar manner concretes made with different aggregates?

One is sometimes led to wonder also whether the seemingly minor differences in beam strength are properly interpreted by the highway engineer. A preliminary series of repeated load tests was made in our laboratory for the purpose of shedding some light on the real significance of comparatively small differences in modulus of rupture of different concretes. Concrete made with 6 bags of cement per cu. yd. was used, one batch containing Potomac River gravel and the other, Martinsburg limestone. The concrete was about 9 months old when placed in our testing machine. The modulus of rupture of the stone concrete was 944 lbs. per sq. in. and of the gravel concrete 836 lbs. per sq. in. Seven beams made with the gravel concrete and six with the stone concrete were then placed end to end around the circumference of our circular track. The beams were supported on knife edges consisting of 1/2 in. steel rods and the span length was so adjusted that the wheel load produced a stress of 440 lbs. per sq. in. which is almost 52 per cent of the modulus of rupture of the gravel concrete. This same stress is something over 46 per cent of the modulus of rupture of the stone concrete.

The wheel was started rolling slowly, at 2 mi. per hr. and three of the gravel beams broke at only 27, 28 and 170 passages respectively. None of the stone beams broke at this early period. It was then decided to discover what strength the remaining beams had after this extremely small number of repeated

¹ For typical evidence of the superior resistance to cracking to crushed stone concrete roads see, "Tests for Determining the Relative Suitability of Concretes for Highways" in *The Crushed Stone Journal* for December, 1936, page 15.

loads. Accordingly, some of the unbroken beams were taken out of the circular track and tested under slowly applied load. The average modulus of rupture of the three stone beams was 624 lbs. per sq. in. and of the four gravel beams, 586 lbs. per sq. in. Both the stone and the gravel concrete beams had been reduced in strength by this small number of repetitions of load. The indications are then that concrete in a highway, after the passage of only a few vehicles producing a not unusual stress, can suffer reduction in strength and by no means does it necessarily have the modulus of rupture indicated by beam specimens tested in the standard manner.

The three remaining stone concrete beams were again subjected to repeated loads in the circular track and one beam broke at 1,082 revolutions; another at 2,563; and a third did not break even after 6300 revolutions. This unbroken beam was taken from the repeated load testing machine and tested under standard conditions with an indicated modulus of rupture of 585 lbs. per sq. in., a stress which is not so very much higher than the 440 lbs. per sq. in. produced by the rolling load.

An interesting point about this test so far as stone and gravel are concerned is the fact that the slightly higher modulus of rupture shown by the stone concrete as compared with the gravel concrete when tested under a single load application, was still enough to produce very much higher resistance in the stone concrete than in the gravel concrete when subjected to repeated rolling loads. The indications are that this particular stone concrete resisted roughly some 400 times as many load applications as the gravel concrete before failure.

As before stated, these tests are entirely preliminary. They need refinement in method but they surely are interesting in their strong indication that comparatively small differences in modulus of rupture may indicate very large differences in repeated load-carrying capacity of highways built with these respective aggregates. This is a point which I do not believe is well understood and it alone may serve to show why, by and large, stone concrete gives superior results.

There are other points to be considered, however, in connection with the development of really indicative tests for concrete quality. The stress produced by moving wheel loads is not slowly applied as in the case of the standard beam specimen; it is applied rapidly and frequently with impact. Therefore, some investigation is needed as to the relative impact resistance of various concretes. We have built a ma-

chine for that purpose and have made some tests but the results thus far have not been promising because of the difficulty of obtaining consistent test values. perhaps we shall be able to overcome this trouble but until we do we shall not be able to determine whether the impact test gives any better agreement with service behavior than the standard beam test.

Another point which should not be overlooked is the great difference in temperature expansion and contraction of concrete due to the differences in coefficient of expansion of the respective aggregates. Some aggregates expand twice as much as others and it seems to be the case that frequently it is those aggregates which show a high amount of cracking in concrete highways. Certainly, investigations along this line give promise, at least, of correlation with service behavior.

What is the effect of freezing and thawing on the service value of the respective concretes and their resistance to repeated loads? We know practically nothing about this point. Does it not seem reasonable to expect more weakening due to release of bond between the mortar and smooth, round, non-porous aggregates than will occur with rough fractured faces? Certainly such an investigation may be enlightening.

(b) *Scaling of Concrete Roads.* Only recently, as you will no doubt learn at this convention, some of the limestone sand concrete roads have shown an excessive amount of scaling, apparently more scaling than in the case of certain natural sand concrete roads subjected to identical conditions. You probably will hear about this trouble in detail and, accordingly, I will merely mention it at this time. This scaling has been attributed in part to the presence of pyrites or iron sulphide in the limestone which, through oxidation and combination, causes the growth of crystals having high volume, in fact some 31 times the volume of the original materials from which they have resulted. This is said to cause internal expansion and disruption of the concrete. The evidence is well substantiated, but at least two other factors which are known to cause scaling were also present. In the first place, most of the limestone sand concrete roads which have scaled have been made with a sand which contained a large percentage of coarse fragments, between the No. 4 and No. 8 size. Such sand produces harsh working concrete and the contractor in his effort to overcome this harshness has added excessive mixing water. The coarse sand is incapable of holding this extra water in position. It rises to the surface and creates a weakened, porous

surface layer which is readily attacked by frost and, consequently, it tends to scale. And second, ice-removing agents have been used which recent tests have demonstrated beyond all doubt will very greatly accelerate the scaling of concrete pavements. And so the presence of sulphides, although apparently objectionable when contained in limestone sand as graded in the past, may not be objectionable in reasonable amounts if the sand is properly graded and if a more plastic and denser mix of concrete is produced. The use of admixtures in the cement may well cure this difficulty. This problem is well worth considerable research by our laboratory.

(c) *Mass Concrete.* A great many hydraulic structures are being built or are in the offing. Crushed stone lends itself admirably to such construction because of the great economies which can be effected due to the use of large size aggregate. But mass concrete generates heat and heat brings about volume change, not only of the portland cement mortar but of the aggregate as well. If there is differential movement of the mortar as compared with the coarse aggregate, internal stresses are set up, perhaps excessive bond stress between the coarse aggregate and the mortar or perhaps excessive tension in the mortar. Whether these stresses are actually excessive is entirely problematical. The adhesion between the mortar and the coarse aggregate becomes important and studies along this line are about to be undertaken in our laboratory. These will include measurements of the relative movement to be expected as between the mortar and the aggregate and also an attempt at a theoretical study of the internal stresses caused by such movement. This problem as applied to mass concrete is a major and fundamental one. It is extremely complicated but a very large tonnage of aggregate is involved and special laboratory studies are needed immediately.

(d) *Stone Sand.* The problems of stone sand have already been touched upon. In our own laboratory we made studies to determine how to write specifications for stone sand and these studies did much to reveal the proper gradation for this material. It is physically possible to grade stone sand to an ideal gradation and consequently we should learn beyond all doubt what that ideal gradation is. Engineers seem loath to admit the use of much dust below the No. 100 sieve in size. Certainly, this fine material makes for better workability and has the effect of holding the water in place. It would not be surprising if, instead of being detrimental, it is actually beneficial in promoting the durability of concrete,

not only of structures, but of highways as well. Further studies along this line would be beneficial and also, as above indicated, studies to determine to what extent sulphides are harmful in limestone sand when that sand is properly graded, remain to be made. Stone sand is such an important product of the industry that full investigation of it surely is warranted.

2. Tests for Coarse Aggregates

In the past we have had a number of physical tests for stone including the Dorry Hardness Test, the Deval Abrasion Test, the Cementing Value Test and the Toughness Test. The usefulness of these tests is now very seriously in question and two of them, the Cementing Value Test and the Dorry Hardness Test have practically been discontinued. The Deval Abrasion Test was originally designed in the days of horse-drawn traffic and waterbound macadam roads and so also was the Toughness Test. Although these two tests have survived, there is doubt as to whether they are really valuable for indicating probable service behavior.

Recently, the Los Angeles Rattler Test has been brought forward and refined to the extent that at least we now know how to make the test so that duplicate results may be obtained in different laboratories. It has been discovered that the results of the Los Angeles Test obtained in different laboratories have better concordance than can be obtained in the same laboratory with the Deval Abrasion Test. Furthermore, the Los Angeles Rattler as applied to stone for use as cover material for bituminous surface treatment work seems to closely simulate service value. Just how reliable the test will be for other types of road construction remains to be demonstrated and continued work should be done along this line, not only in our laboratory, but by a number of laboratories in cooperation with one another.

3. Stabilized Roads

We have had some form of stabilized road surface in the United States for many years; thus the sand-clay and top-soil roads of the South furnish examples. Only recently, however, due to the extensive advertising of the producers of calcium chloride and of salt, the stabilized form of highway surface has become exceedingly popular.

The stabilized road consists essentially of some type of aggregate bound together with finer material

to hold it in a stable condition. In some cases calcium chloride is used to control the water content and thus maintain more uniform stability throughout the year. Sodium chloride or common salt likewise is used for the same purpose. Portland cement has been employed in several experiments as a binding medium to hold the fine particles together and bituminous materials including both tar and asphalt have also been used, not only to bind the particles together but to exclude the moisture.

Crushed stone producers must find their place in this stabilized road program and this should not be difficult because crushed stone possesses excellent properties for creating a stabilized surface. It has a natural interlocking effect when compacted and most stone dusts also have a cementing property which may be augmented by the use of an admixed cementing medium. The best methods of using crushed stone for stabilized surfaces have not been determined any more than this is the case with other types of aggregates.

When a stabilized layer is surface treated with bituminous material, a different condition of moisture is set up than was the case before the surface treatment was made and a road after surface treatment may become unstable whereas previously it was stable. In view of the fact that many of these stabilized surfaces are to be looked upon as bases, later to be surface treated, it becomes an important problem to determine the conditions which make for high stability when surface treated with bituminous material. The proper combinations of stone with the various admixed materials should be investigated so that the greatest economy will result. We have begun on this problem in our laboratory, first with small specimens consisting of 4-inch diameter cylinders, 2½ inches in height which are subjected to an extrusion test much after the nature of the Hubbard-Field test for determining the stability of bituminous materials, but designed, however, especially for stabilized surfaces. We anticipate following these small sized tests by the use of our circular track. We are well fitted with our circular track equipment for performing investigations of this nature and there is no reason why useful results of great value to our industry should not be obtained. That at least will be our effort.

4. Bituminous Surface Treatments

The bituminous surface treated road, always an important type of surfacing is now becoming of even greater importance than hitherto because of the em-

phasis on low-cost roads. It is my opinion that ultimately most of the stabilized surfaces will be waterproofed with bituminous material to keep them in a condition of maximum stability and also to greatly improve their wearing properties. The use of crushed stone as a cover material for the bituminous treatment, whether of tar or asphalt, will furnish a good outlet for stone. Although excellent results have already been obtained with bituminous surface treatments, new problems are continuously arising. For illustration, the question of gradation limitation has not been solved; the effect of porosity of the stone on the type of bituminous material which had best be used; the matter of permissible amounts of dust; the question of the necessary physical test requirements, especially with the Los Angeles Rattler; and the effect of condition of moisture of the stone when being used as a cover material. All of these are important questions which are in need of definite solution in order that optimum results may be obtained and so that the least amount of production trouble will ensue.

5. Bituminous Mixtures

Technologists in the bituminous field are continuously working on different phases of bituminous mixtures. A large number of proprietary compounds are on the market, having different degrees of merit. We have found that these mixtures have their limitations; some of them work well with certain stones and not with others and some are more durable than others. We have been able to overcome difficulties in making satisfactory bituminous mixtures through the experiments we have conducted in the past year in our laboratory, making use of our circular track to obtain our results quickly. If the stone has a tendency to release its bituminous film in the presence of water, we now feel that we can overcome that particular difficulty.

When a producer is importuned to become aligned with any particular proprietary mixture, through our laboratory facilities we can quickly give advice as to how his stone will behave when made into that particular mixture. These problems have arisen in the past and they are almost sure to arise in the future. With our track equipment we can make accelerated traffic tests which in the course of a few days will simulate years of exposure to traffic. This form of technical service in the past has been of value to our members.

(Continued on page 35)

Outlook for Federal Legislation Affecting Industry¹

By JOHN C. GALL

Associate Counsel, National Association
of Manufacturers, Washington, D. C.

I HAVE been asked to talk to you about legislation in this Congress of interest to industry and which might affect industry, and which had some chance of passage. It is very difficult to differentiate. Up to night before last, that is through the 18th of January, in thirteen days by the calendar since this Congress convened, there had been introduced approximately 5,000 bills and resolutions. You can see the physical job of looking them over is immense, to say nothing of trying to analyze specific proposals.

During a 2-year Congress we have normally an introduction of about 20,000 bills and resolutions. Of course, that includes many private bills as well as public bills, so it is misleading to think that they all have to be examined with minute care to see what they mean to industry. Nevertheless, a large percentage do affect industry in greater or less degree. It is difficult to tell when a measure does and when it does not affect industry. Furthermore, I think we should keep in mind that many measures which affect industry don't affect all industry alike. I could illustrate that best perhaps by two measures with which you are all familiar: The Social Security Act would be the first one.

I notice in the very admirable report of your Resolutions Committee a reference to the fact that labor cost in this industry is very high in relation to the total cost of output. Necessarily the Social Security Act bears with especial harshness on industries in which labor cost is high in proportion to the total cost. The consequence is that that Act does not affect all industry in the same way. It affects much more harshly those industries which have a very high labor cost, and that, as I undertook to point out last year when you met in January in St. Louis, is a very significant phase of the whole Act because it was adopted at a time of very high unemployment, at a time when reemployment was the watchword of the day, and yet it is based on a tax on pay rolls which, more than any other form of tax which could

♦ During a session of Congress there are normally introduced a large percentage of bills which affect industry in more or less degree, and it is becoming increasingly important that business men know which of the many legislative proposals submitted are of vital concern and have some possibility of passage. No one in the country, within our knowledge, follows the legislative situation more closely or is more capable of accurately interpreting the probable course of bills than is Mr. Gall. With the first session of the Seventy-Fifth Congress now well launched, the following observations by Mr. Gall are most timely and should prove definitely helpful in assisting crushed stone producers to a better understanding of the legislative outlook.

be devised, is a brake on reemployment of men and an encouragement to the substitution of machinery and labor-saving devices for the labor of man.

A second illustration of the point that I have just tried to make of the differing effect of a piece of legislation on different industries and different branches of the same industry is the Robinson-Patman Act, a measure designed, it is said, to strengthen the Clayton Act in its prohibition against price discriminations, and yet you will find that the impact of that Act is quite different on different industries and different branches of the same industry. It depends on whether a man considers himself primarily in the role of a seller or of a buyer as to what his attitude is toward that Act. In industries which have a very high raw material cost you will find that manufacturers are more concerned with themselves as buyers under that Act; in industries which have a very low cost for raw materials and a very high cost for labor you will find that they are concerned almost entirely with the application of that Act to them as sellers and not as buyers.

We often hear it said that industry doesn't have an affirmative program. "Why doesn't business get together? Labor gets together and has a program; other groups get together and have a program." I think the answer is a perfectly logical and a perfectly obvious one, that the interests of different branches of industry are not the same with respect to any given proposal and consequently it is impossible for them to get together in the same way that labor and other groups can. It would be very easy for all the men in this room to get together if all

¹ Presented at the Twentieth Annual Convention of the National Crushed Stone Association, at Cincinnati, Ohio, January 18-20, 1937.

they had to get together on was one fact and that was that they all wanted something that they thought some other group had, and that is approximately the situation of labor organizations and groups other than the producing and manufacturing interests of the country.

I am not saying that as an apology for the failure of industry to get together; I am saying it more by way of explanation, because it seems to me that the comment that business never gets together is more thoughtless than appears at first glance. There are real reasons for it.

What legislation affects industry? Most legislators and a good many of us, I am afraid, take the view that the only effect of legislation on industry when it increases costs of doing business is that industry gets together and passes the cost on to the consumer and that is all there is to it. Unfortunately, or perhaps fortunately for the consumer, that isn't the fact, and you know it isn't. The trouble is that the legislator very often confuses cause and effect and he doesn't realize that what he thinks is cause is really effect. It is like the woman who says to her neighbor, "Does your husband eat cloves? Mine does. I have tried to get him to stop it because he always has a headache afterwards, but I can't get him to stop it." It seems to me that is a perfectly obvious comment on the state of mind of people who think that the way to produce prosperity is simply to legislate high wages and high cost of production, and I think you will agree that that isn't true. High wages go with prosperity, but high wages are an effect of prosperity and not a cause of it, and legislation which produces those wages doesn't necessarily produce prosperity.

Let me run briefly over a few of the issues that I know you are interested in in the way of legislation and with some little speculation as to what probably will happen at this session of Congress.

On the question of taxation, I do not anticipate that there will be any substantial change in the federal tax laws at this session of Congress, even the undistributed surplus tax law, and I say that because I know in the administration itself and in Congress there is a general recognition that that Act needs very drastic change; nevertheless, it was a campaign issue and having been such, it is unreasonable to suppose that the administration is going to open the subject up and recommend drastic reversal of policy at this time. I do not think it will be done.

Tariff. I look for no new legislation except an ex-

tension of the power of the President to negotiate reciprocal trade agreements.

Social Security

On Social Security there are a number of very important amendments which have been proposed, some of them in the right direction from the standpoint of industry, some of them, I think, in exactly the reverse direction. The first question that naturally arises is whether the operation of the provisions of the Social Security Act will be postponed because of the failure of a number of states to enact state legislation. I do not think it will be postponed. I think the influence of the administration, together with the influence of those states which have passed legislation, is sufficient to prevent any action on the part of Congress to postpone the effective date of any of the provisions of the Social Security Act.

Secondly, the question of private pension plans: I don't know how many companies in your industry may have private pension plans. It is too bad that in passing the Social Security Act no provision was made whereby companies which maintained private pension plans could get some recognition of those plans and some exemption in relation to the amount spent to maintain those plans. There is, as you probably know, no exemption of that kind in the Act, and in my opinion there will be no exemption accorded at this session of Congress. I will say, however, that I think the proposal to recognize those plans and give them some measure of exemption has more chance of adoption than any other important proposal to amend the Social Security Act at this session of Congress.

The labor organizations have proposed that the employees' contribution provision under Title VIII, that is the old age annuity section of the Act, should be repealed. I do not believe that will be done. I think it was very unfortunate that that became a campaign issue last summer, because the administration, if it were so inclined, could now find a perfectly valid reason for going along with the labor organizations on that point. Nevertheless, I believe that the administration is going to stand against any repeal of the provisions for employee contribution under the old age annuity section.

I wish that it had been provided in the Act that there should be employee contributions under the unemployment insurance acts of the states as well. As you know, some states provide for it and some do not. I think in the interest of a sound, permanent system that provision should have been made, as it

was made in England, for employee contributions would operate as a brake on the unwise opening up and extension of the unemployment benefits of the States, but that has not been done and I do not think it will be done.

The President has been quoted, although not directly, as favoring some change in the law under which this tremendous reserve fund will be accumulated under the old age annuity sections of the Act. I do not believe that the President will recommend to Congress at this session that anything be done with respect to that fund. In other words, gentlemen, while there are a number of suggestions for amendment in basic particulars of the social security legislation, I do not anticipate that any of these amendments will be adopted at this session, unless possibly it is one which gives recognition to the status of private pension plans which many companies now maintain, and under which I understand approximately 3,000,000 employees are now entitled to benefits in many companies in excess of the benefits under the old age annuity provisions of the Social Security Act.

The 30-hour bill I think has no chance of passage, nor has any other bill which fixes by congressional enactment a rigid maximum number of working hours in industry. The administration doesn't want it, industry doesn't want it, every economist of note in the country has condemned it as leading only to higher costs and not to greater employment, and many of the labor organizations themselves do not really want it at heart. It has been used ever since before the National Industrial Recovery Act was passed as a method of getting other legislation by using the 30-hour bill as a club, and for that purpose it undoubtedly will be used at this session of Congress, but I do not anticipate anything like the 30-hour bill will be seriously pressed to passage in this session.

Collective bargaining. I look for no legislation unless and until the National Labor Relations Act has been thrown out by the Supreme Court of the United States. That Act will be argued before the Supreme Court on February 8 in five cases that are pending there. I can see no result in the light of the uniform decisions of the court except that that Act will be declared invalid as applied to manufacturing and production. It seems to me that there is no alternative open to the court, although I believe that the Act will be sustained in its application within very narrow limits to employees actually engaged in interstate commerce, primarily in transportation.

The Guffey Coal Act which was invalidated by the Supreme Court will probably be passed again in a somewhat revised form, leaving out the major provisions to which the Supreme Court took exception in its decision last summer. I look for no other of the bills setting up "little NRA's," so-called, for specific industries, to pass at this session of Congress. I do not believe that the Ellenbogen Bill, for instance, for the textile industry, or the bill for the iron and steel industry, will become law. As I see it, only the bill in which John Lewis is particularly interested, the Guffey Coal Bill, is going to be enacted at this session of Congress.

On the government reorganization scheme, I think something will go through. I do not believe it will be anything like the President has submitted. I do not believe the Congress will consent either to the emasculation of the semi-independent agencies, such as the Interstate Commerce Commission and the Federal Trade Commission, or to the abolition of the Office of Comptroller General, but in general I believe that the President's scheme of lumping all the administrative agencies of the government under a number of cabinet heads, perhaps increased by two, will be adopted. I do not anticipate that this will result in any savings whatever to the government in the form of money. It may result ultimately in some savings due to increased efficiency, but that remains to be seen.

Amendment of Anti-Trust Acts

Amendment of the anti-trust acts. I should like to utter, if I may, a word of caution about proposals to amend the anti-trust acts of the United States. I know that your Resolutions Committee has been very careful in making certain distinctions in its report. I distinguish in my own mind between proposals to change the basic law, that is the substantive law itself, and proposals to change the method of administration. I think for business to get behind proposals to change the substantive law is very dangerous. I believe that business men as a whole are in sympathy with the basic purposes of the anti-trust laws as expressed in your report. I think that in anything business men say, or in lending their support to moves to amend the anti-trust acts, they should make it very clear that what they are talking about is a change in method of administering the basic laws which exist.

Business has a right to know something of the rules under which it is operating. It has a right to go to the Government and ask for an expression of

the Government's attitude toward proposed conduct. Beyond that I don't think that business wants any fundamental changes in the anti-trust laws. I may be wrong in that but I am reflecting what I believe to be a conscientious attitude of the great majority of the members of our own organization and of industries in general that I have come in contact with, so I would urge you that when the subject of amendment of the anti-trust laws is discussed, you differentiate very clearly between a change in the basic prohibitions of the laws themselves and a change in the method of administering those laws. The Government in administering such measures as the Robinson-Patman Act, which is part of the anti-trust laws, should let business men know in advance what the attitude of the Government is toward the conduct in which business men expect or hope to engage.

I believe there is a great deal that can be done under the anti-trust laws in the way of voluntary co-operative effort without violating the acts as they at present stand, and that under proper legal advice groups can do a great many things that they haven't yet tried. For instance, it has been said by many people, and particularly by some of the people in the administration, that amendment of the substantive laws themselves is necessary before business men can agree in an industry as to minimum wages and maximum hours. I deny that. There is no case in the Supreme Court of the United States which throws any doubt whatever on the ability of business men under the present anti-trust acts to enter into reasonable agreements with respect to wages and hours. On the contrary, there are decisions, and in particular such decisions as that affecting the window glass manufacturers and their employees (who were union members by the way) under which the Court has said that an industry may go very far in entering into voluntary agreements with respect to working conditions in the industry without in any way violating the anti-trust laws; and in the Appalachian Coals case where a large number of coal operators formed a common selling agency, the court used language there which makes it clear that business has not even explored the possibilities of voluntary action under the anti-trust laws. So I want to urge you in any consideration of this subject to give consideration to the things which you may wish to do, to the limits which the Court has indicated you may go, and before urging any change in the basic laws to consider whether you may not do what you wish to do under the existing laws.

I should like to mention in that connection something that is often overlooked by business men when they talk about opening up the subject of the anti-trust laws for amendment. That is, today with the country filled with strikes and disorder the only federal statute under which the Federal Government can move today in the prevention of labor disorders or can move against a labor organization that is disrupting interstate commerce, is the Sherman Act. There is no other statute, and in the present temper of political thought in this country I should like to submit to you the question whether if the subject of the anti-trust laws is opened for amendment, we are not in more danger of losing this necessary control in the public interest than we are of gaining privileges that some business men would like to gain by amending the anti-trust laws. That it seems to me is an important aspect of the case.

While I am mentioning the subject of labor organizations, may I refer to one other thing.

There is a very wide spread public impression that business men are responsible for the attitude of the courts that Congress has no authority over manufacture and production, and particularly over wages and hours in manufacture and production; that it is business men who have resisted federal authority in those fields and that the courts have more or less acted as the minions and tools of business men in laying down the law that way. Now nothing could be further from the truth. I should like to point out to you that beginning in the early 1890's when the famous Debs case was before the Supreme Court, coming down through the Danbury Hatters' case, the Duplex Printing case and the Journeyman Stonecutters' case, and any number of other cases to which union labor has been a party before the Supreme Court, the issue has been this: May the federal courts assert jurisdiction over strikes and combinations in manufacturing and production? And the uniform position of the labor unions, including Mr. John L. Lewis' United Mine Workers in the Coronada Coal cases, has been this: They have said to the Court, "The Federal Government has no jurisdiction over this strike because this strike is only in manufacturing or production and the Commerce Clause doesn't cover it," and the Court has agreed with the unions for these fifty years on that proposition. So I say to you gentlemen that instead of the courts being the tools of business and simply agreeing with a rule of law which was convenient for business men, the courts have uniformly agreed with labor organizations in their position that strikes and

tie-ups in manufacturing and production were not in commerce so as to justify federal intervention.

It seems to me that is an issue that ought to be kept clear when we hear the courts under such violent attack as they are today. It is not a rule that they have laid down for business men; it is a rule which they have laid down equally at the request of employees.

Congress Faces Four Big Issues

As I see it, the four big issues before this session of Congress may be described as follows: First, federal control of industry, including wages, hours and conditions of employment; essentially the whole question of the revival of the National Recovery Act.

Second, amendment of the Federal Constitution to confer upon Congress permanent authority over local production, manufacture, mining, agriculture and trade.

Third, limitation of the powers of the federal courts, particularly as to passing on the validity of acts of Congress.

Fourth, federal spending policies, especially in the field of direct relief.

Gentlemen, all these other things that I have referred to are important and they are interesting, but when you come down to it, these are the essential questions. They revolve around revival in some form of a centralized federal authority over the things which the Supreme Court says in the Schechter, the Panama Refining, the AAA and the Guffey Coal cases the Federal Government cannot regulate. I am not going to argue the policy of centralized regulation of those subjects. I couldn't improve on what you have said here in your resolutions. All I can hope to do is to bring to your attention the fact that these are the issues before Congress, that they are the important issues, and that everything else can be dispensed with and we can center our attention on those things, because nothing else really matters if that program of centralized authority is adopted.

The President has said that he does not favor at this time submitting a constitutional amendment to the states on those subjects. I would like to call your attention to the language in which the President said that, because I do not consider that it is in any way conclusive. Neither do I see any necessary inconsistency in the fact that he said that and the fact that Senator Robinson and Senator Ashurst and

other administration leaders in Congress have gone ahead with their statements that they favored such an amendment. It seems to me perfectly logical that the President would tell them to go ahead and sound out opinion on it and hold hearings and lay the groundwork, because the big question is what the Supreme Court is going to do with the Wagner Labor Relations Act and the Social Security Act, and if those acts are invalidated by the Court there is no question in my mind that the President will get behind the proposals for amendment of the Constitution as suggested by Senator Robinson and Senator Ashurst.

The question of federal control without an amendment of the Constitution it seems to me centers up in the proposal of Senator O'Mahoney of Wyoming for the licensing of industry, a proposal which has been ably discussed, and to which I think I could add nothing, in the report of your Resolutions Committee. I understand Mr. Williams had a great deal to do with the very clear way in which that matter is stated in your resolutions.

I should like to call your attention to two or three specific things in the O'Mahoney Bill which otherwise might escape your notice. We took this matter up and discussed it in the report of a committee of our Association in December of which Mr. Graves was a very important and a very active member. I should like to point out three or four things which illustrate the extent to which the federal authority would be stretched.

In the first place, you couldn't do business in interstate commerce as defined in the bill (and interstate commerce is defined in the bill to include practically all the things the Court said in the Schechter case couldn't be treated as interstate commerce) without securing a license. As pointed out in your report, the bill implies that corporations only must obtain licenses, but the bill further says that the Commission may subject to the jurisdiction of the Commission and of the Federal Government individuals as well as corporations where it is necessary in order to make the policy of the act effective. Under the "blanket license" provision no distinction is made between corporations and individuals. So for all practical purposes it is a bill to license every corporation, every partnership, every association and every individual doing business within the continental boundaries of the United States when we take into consideration the definition of commerce laid down in the bill.

"Every license would contain conditions giving to the Federal Government control over wages, hours and working conditions, and binding the licensee to comply with the terms of the National Labor Relations Act. It would be made binding upon the Commission to follow the findings of fact and conclusions of law of the National Labor Relations Board." Now get the effect of that: The Labor Relations Board says that the Act is constitutional and that it applies in a certain situation. The courts of the United States say that it isn't and that it doesn't. According to this bill, you would be required as a condition of your license to agree to follow the findings of the National Labor Relations Board irrespective of what the courts said.

Second, I pointed to the extension of the licensing system to individuals in the discretion of the Commission which it seems to me is a very important feature of the bill. "The Commission would have broad power to suspend or modify licenses and could revoke them for violation of any of their terms"—thus in effect, gentlemen, banishing anybody from doing business at all after his license was revoked. "In the event of a labor dispute, if the Commission should conclude that the licensee was at fault and had caused directly or indirectly the protection or escorting of strikebreakers by police, constabulary, militia, or any other armed forces, it would become mandatory upon the Commission to revoke the license."

Take the situation where there is a strike, the men walk out, the plant is vacant (we will assume this is not a sit-down strike) and you fill their places with people who want to work, and in order to preserve law and order it is necessary for you to call on the duly constituted authorities: Under this bill it would become mandatory upon the Commission to revoke your license to do business, while on the opposite side of the street a man who had a strike and who brought in strikebreakers and didn't resort to the duly constituted authorities but brought in a bunch of thugs to get them through, wouldn't have his license revoked—in other words, a premium to the man who doesn't avail himself of the duly constituted legal authorities to protect the right of his employees to work, and a penalty to the man who does.

"The various departments and bureaus of the government would be required to turn over to the Commission, upon its request, all records, papers, and information in their possession 'relating to any of the provisions of this Act.'"

Gentlemen, there couldn't be any more sweeping authority to a commission to invade privacy. There is no exception of income tax returns of individuals or corporations that may be under investigation. That it seems to me in itself illustrates the very sweeping character of this bill and its disregard of all private rights whatever.

I don't want to dwell longer on the details of the bill other than to point out that as one of my associates said of it, it seems to be an "anthology of invalid legislation," because it not only disregards private rights, it not only oversteps the bounds of federal authority as the Court has declared them; it invades under the Fourth Amendment the prohibitions regarding all rights of privacy as in respect to income tax returns, and it confers on a commission of the government authority which the Supreme Court justly characterized as unfettered discretion to do almost whatever it wants to do in regulating the internal affairs of business corporations and even of individuals engaged in business.

It seems to me that no statement that you make at this meeting could be too strong with respect to this measure, and that you have very wisely taken the position that even though the objectives of the National Industrial Recovery Act and of this measure may be all right in themselves, this is certainly not the method for reaching them.

The Walsh-Healey Act

Since you met in St. Louis the Walsh-Healey Act has been passed and I know that all of you are very much concerned with its operation. Briefly stated, that Act requires that in all contracts in excess of \$10,000 which are not exempted under the Act the purchasing agencies of the government shall require certain conditions with respect to your operations. Those dealing with child labor you are familiar with. The ones that are of primary concern to you relate to wages and hours. So far as wages are concerned, the Secretary of Labor is given authority in respect of all those contracts to prescribe minimum wages. The Act went into effect September 28 and no minimum wages have yet been prescribed by the Secretary of Labor, but the authority is there. In respect of hours, a maximum number of forty hours per week or eight hours per day is prescribed. After that you may work even without a specific permit from the Secretary of Labor any number of hours you choose, provided you pay time and a half for overtime.

There was a provision in the Act that contracts for goods which could ordinarily be bought in the open market were exempt from the Act. That exemption or that exception has been practically nullified by the Secretary of Labor by regulation, because the Secretary has provided that the only contracts over \$10,000 which are exempt are those where the contracting agents of the government are not required to advertise for bids. Well, since the contracting officers of the government are required to advertise for bids in practically all cases over \$10,000, the regulation means nothing except that the exemption that Congress intended in the Act has been nullified by the Secretary of Labor.

Another provision of the regulations which is very important and with which some of you may have had contact is that where an employee touches a government job for one hour in the week, that fixes his status for the entire week, and that the limit on his hours, whether he is engaged in private work for the rest of the week or engaged in public work, is forty hours for the week and eight hours per day, after that overtime being required. In other words, doing any work on a government contract job "contaminates" the employee in a legal sense and the employer is required to observe the maximum hour and overtime requirements of the Act and regulations with respect to that employee for that week.

The chief fight that will center around this Act at this session of Congress is the desire of the Secretary of Labor to get the Act extended in accordance with the original proposal which I discussed last January. The proposal will be made, and with strong support, that the \$10,000 limit should be reduced to say \$2,000, and that the Act should be binding not only on primary contractors with the Federal Government but on sub-contractors as well, all the way back. I would not want to predict what the outcome will be. That will be referred to the Judiciary Committee of the House of Representatives which is the committee that handled it the last time. It is a very fair committee. I do not think the committee will want to extend the act. The pressure, however, from administration and labor sources is going to be tremendous and you can see very well what we are going to be up against.

The Robinson-Patman Act

Since you met in January last year the Robinson-Patman Act has been passed to supplement the Clay-

ton Act in prohibitions against price discriminations. I think that no business man who is fair and honest (and Mr. Roosevelt admits that over 90 per cent of them are, so we may take that as a minimum) will contend that business wants to engage in unfair practices, or that it wants to make unjust and unfair discriminations in prices or terms among its customers who are entitled to equal treatment. I think, however, that in the passage of the Robinson-Patman Act a great deal of damage has been done and more damage has been threatened to the business structure of this country than was justified by the circumstances which dictated its passage. I believe that the prohibition of the Clayton Act, which was that both direct and indirect price discriminations were prohibited in commerce, was adequate as it was being interpreted by the Federal Trade Commission without the passage of the new act. Consequently, the objection as I see it is not to the objective of the Act but to the method employed. We have here a very sweeping, a very vague and general statute, applying not only to the sale of commodities over the counter, which was the original cry for the legislation, but to all business and all commodities, which prohibits price discriminations and certain discriminations in terms as well, not only in interstate commerce but under a new standard fixed in this Act they use intra-state transactions for comparative purposes with interstate transactions, with the result that not only are very serious practical questions raised but very serious legal questions as well as to how this Act may validly be applied in the field of local commerce.

We have, furthermore, the sweeping prohibitions against price discriminations with only certain specified defenses in the Act. Those defenses are very limited and very narrow. The first question that the courts will have to face is this: Are those defenses exclusive? In other words, gentlemen, if you are charged with making price variations between certain customers, must you bring your defense within the terms of one of these special, narrow provisos set forth in the Act or may you bring in any other matter of legitimate defense for such a price discrimination? In my judgment, unless the courts apply a rule of reason to this Act as they did to the Sherman Act and the Clayton Act and hold that these defenses are not exclusive, the whole Act will be in jeopardy in a constitutional sense, because the courts have held uniformly that Congress may violate the prohibitions of the Constitution just as well by denying remedies as by destroying rights, and in

my judgment, taking into consideration the language of the entire Act, you are entitled to plead other defenses than those set forth in the Act in proper cases.

You will note that the Act does not say that a cease and desist order shall be issued unless you can prove one of these defenses. It says, on the contrary, that nothing in this Act shall prevent your proving so-and-so by way of defense, and that is quite a different legal matter from the other approach; so that nothing in this Act prevents your defending on the grounds in the Act, but it may well be the courts will say nothing in the Act prevents your defending on other grounds which are not stated in the Act.

I do not want to discuss too much the details of this measure. I undertook to do that at Mr. Boyd's request in *The Crushed Stone Journal*. How well I succeeded in doing so, or how poorly, you know by now. We have little in the way of authority. The Federal Trade Commission has issued fourteen complaints under this Act; some are in the stage of hearing. There are no decisions of the Commission. There has been only one thing of an authoritative nature and that is an opinion of the Attorney General to the effect that sales to government agencies are not within the Act. In the article which I wrote for *The Crushed Stone Journal* you may recall that I discussed that problem and pointed out that the government might just as well reach one result as the other, but intimated they would reach the result which they did; it always seemed to me that they must for purely policy reasons; yet I can see no logic for saying that if it is unfair competition to discriminate as between private customers, the same conduct shouldn't be regarded as unfair competition in dealing with the government.

The effect of the Attorney General's opinion is this, in my opinion, that his logic applies equally well to sales to states and municipalities, and that if he can hold that sales to the Federal Government and its agencies are not within the Robinson-Patman Act, the same result must follow with respect to all sales to public agencies as distinguished from private.

Secondly, I think we should keep in mind that the Attorney General has no authority to commit the courts or to estop them, and while he may fix the attitude of the government in a proceeding by the Federal Trade Commission, it might well be that in a private proceeding by some injured competitor the courts would reach a different result as to the application of the Act.

I have undertaken to reduce to writing a few amendments to the Robinson-Patman Act which have been urged by various business groups.

First, that the provision permitting private suits for treble damages should be stricken out or suspended for a term of years until such time as the meaning of the various provisions of the Act can be ascertained through Commission and court proceedings. Since we cannot get advance interpretations, business should at least be immune from unlimited private suits of this nature during the period of uncertainty.

Second, the criminal section should be stricken out. The other penalties of the Act are serious enough and in view of the difficulties of interpretation it seems reasonable to ask that no criminal penalties be invoked during the necessary period of interpretation of the Act.

Third, the Act now applies to all commodities whether sold for use in consumption, further manufacture or resale, yet the declared purpose of the Act was to protect ultimate consumers. As you know, the Act was originally advocated as an anti-chain store measure. An amendment should be adopted which will exempt from the operation of the Act sales of machinery, equipment, and so forth, for use in manufacture or production of other goods. It has also been suggested in some quarters that the sale of goods for further manufacture should be exempt.

Fourth, a number of words and phrases used in the Act are susceptible of two or more interpretations. In most of these cases the interpretation most favorable to the plaintiff (that is usually the government) would be disastrous to the respondent. These words and phrases should be defined in the Act. Without enumerating, in general they are the same words and phrases to which you have referred in your own report.

Fifth, some recognition of the legality of the functional differentials, that is differentials based on a classification of customers, should be included in the Act in addition to the implied recognition in the due allowance proviso.

Finally, the discretion of the Federal Trade Commission to impose quantity limits should be defined and limited.

These are some of the principal amendments which may eventually be urged upon Congress.

Gentlemen, may I suspend with just a few words about the budget situation and the federal spending policies, and then I know you undoubtedly have

some questions you want to ask about specific measures. That is why I have tried not to go too much into detail about specific things.

The President set up a budget that indicates no possibility of being in balance this year or next; he says possibly the next year, and the big "if," he says, is whether employers take people off the relief rolls so as to cut down the amount necessary for relief. I know there is a great deal said about cooperating with the administration. My own Association has, I think, held out the right hand of cooperation more than many people might have expected at the time it was done. I know that you are in the same state of mind, but this cooperation business must work both ways. You can't have cooperation without a mutual desire on both sides.

The President in his budget message, it seems to me, failed to give recognition to the extent to which industry has already cooperated by taking people back into regular employment. We made a poll of our own membership to which we got a 45 per cent response, which is not large but still is larger than you usually get to a poll of that kind, as to the extent of employment as compared with 1929, and the report was 106 per cent of 1929 from the 45 per cent of our members who responded. Consequently, if the President means by "industry" the manufacturing and producing businesses of this country, I think some recognition should be given to the fact that a great deal has already been done in that direction in the way of cooperation.

As far as the relief problem is concerned, it is a striking thing that the relief expenditures of the Federal Government are above what they have been during the years when the depression was at its very worst. The unemployment problem in this country is a different problem today from what it was four years ago, and that is something I think we can't impress too strongly on our public representatives. Four years ago it was a question of involuntary unemployment and today it is largely a question of voluntary unemployment. The strikes on the Pacific Coast and the sit-down strikes through Michigan, Ohio and other states are examples of voluntary unemployment.

A lot of people would say you shouldn't give relief to strikers. I would say normally that is a sound position to take, even though it sounds harsh, but today you can't say that because we know over half the people on strike in this country today don't want to be on strike; they want jobs; they want to work

and they are prevented from working by a small minority of their fellows who are precipitating and maintaining the strikes. The consequence is that it would be unfortunate if the people who want to work and can't get work should be denied relief in any blanket way.

Labor Organization Responsibility

Nevertheless, I think the time has come or is rapidly coming when public interest in continued operation of our industrial machinery is going to assert itself and some control over labor organizations which are precipitating these interruptions of business and commerce, is going to be asserted. The form of that regulation is not clear. We all ought to hope that it isn't going to be too drastic. We don't want to see so drastic a change in our relation to voluntary organization that it amounts to fascism, but some regulation in the public interest is coming.

Today the Federal Government says to the employer, you must bargain collectively and exclusively with the representatives of a majority of your employees. And yet the representatives of our employees don't have to show any credentials at all. You may have a union that is communistic, you may have a union that engages in general and sympathetic strikes, you may have a union that is officered by ex-convicts (as some are, because we have records of them), you may have a union the officers of which have embezzled union funds and been prosecuted for it, you may have unions which violate their contracts, you may have unions that are dedicated to the principles of coercion, mass picketing, restraint, intimidation—and yet today the employer can't say to the union representative anything except one thing: Do you represent a majority of my men? And if he does the employer has to deal with him, if the Wagner Act is valid.

Gentlemen, that situation can't continue long and I think just a few more things like the automobile strike in Michigan and the disastrous results it has had, are going to force the public to demand in its own interest, not the interest of employers, some responsibility on the part of labor organizations as well as on the part of employers who give employment to the millions of industrial workmen in this country.

Mr. Chairman, I am going to suspend at that point and I will be glad to try to answer any questions that I can.

Significant Developments in Highway Investigations¹

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IN ANY line of continuous endeavor it is advantageous to pause occasionally and take stock of our assets and our liabilities. In the commercial world the value and necessity of the annual inventory is universally recognized. In the field of research it is equally necessary to make an occasional survey of what we know and what we do not know; to evaluate the facts that have been established and, from the vast number of unsolved problems, to select those whose immediate solution is most urgently required. Without such a summarization of past accomplishments and future aims we are likely to fail in securing the greatest possible benefit from past and future activities. It is the purpose of this discussion to present a brief summary of the more recent accomplishments and the present trends in those phases of highway research which are of particular interest to the crushed stone industry.

Design of Concrete Paving Mixtures

In the earlier days of concrete little thought was given to the nature of the mineral aggregate used except to require it to be durable and reasonably hard. The aggregate was considered largely as a filler material necessary to reduce the amount of the more expensive ingredient, cement. With the development of our present knowledge of the relationship between strength and water-cement ratio came the realization that *grading* of the aggregate plays an important part in controlling the amount of cement necessary to produce concrete of a given strength. But still little or no attention was given to the possibility that inherent characteristics of the aggregate, as well as its grading, might affect the strength of concrete. It was generally assumed that strength was controlled entirely by the water-cement ratio and that so long as the aggregate was sound and durable its other characteristics were of no importance.

♦ Research plays a highly important role in advancing the products of an industry. It paves the way to new uses or more advantageous uses of materials. In the following article Mr. Kelley presents a brief summary of the more recent accomplishments and the present trends in those phases of highway research which are of particular interest to the crushed stone industry.

We have now learned that characteristics of the aggregate, other than soundness and grading, are important. We know that flexural strength, the essential strength characteristic of paving concrete, may be influenced greatly by the *kind* of coarse aggregate used. In extreme cases a change in the kind of coarse aggregate may cause a reduction in flexural strength as great as would be caused by the omission of one sack of cement per cubic yard of concrete. The nature of the coarse aggregate *cannot* be ignored when designing concrete paving mixtures.

For a given combination of aggregates and cement the flexural strength of the concrete is governed by the well-known water-cement ratio law. That is, the strength increases as the ratio of water to cement decreases and, for a fixed ratio of water to cement, reasonably uniform strengths may be expected. However, this does not mean that with some fixed water-cement ratio the same strengths will necessarily be obtained with all kinds and combinations of aggregates. With the same water-cement ratio the strengths of two concretes may be quite different, depending entirely on the kind of aggregate used. These facts have led the Bureau of Public Roads to favor the so-called trial method of designing concrete for pavements.

The trial method of design makes it possible to differentiate between available aggregates on the basis of their influence on flexural strength. The water-cement ratio that should be used with each different combination of aggregates to obtain the desired or specified strength is determined by means of controlled laboratory tests. Differences in the characteristics of the aggregates available in a given territory are likely to cause variations in the water-cement ratio required for different combinations of materials, with resulting variations in the amount of cement required per cubic yard of concrete. Hence, the aggregate producer's interest in this method of design.

¹ Presented at the Twentieth Annual Convention of the National Crushed Stone Association, at Cincinnati, Ohio, January 18-20, 1937.

Arguments are advanced both for and against the trial method of design. In its favor is the fact that it permits us to utilize our present knowledge to obtain, irrespective of the aggregates used, concrete pavements of reasonably uniform strength. Opposed to it is the argument that strength is not the only desirable characteristic of concrete; that durability and freedom from cracking are of equal or greater importance and that the method does not insure the production of concrete having these characteristics. While this is true, it does not seem reasonable to ignore the few facts already established while awaiting that far distant time when all facts will be known. The knowledge required to insure the manufacture of concrete of unquestionable quality remains to be developed by future research.

The trial method of concrete design is not one to be used indiscriminately and without restriction. It is obvious that the laboratory tests should be made with the greatest care and in accordance with a standard procedure in order to avoid the possibility of unfair discrimination. The method should be adopted only by organizations prepared to exercise this requisite laboratory control and to perform expeditiously the many tests which will be required. Furthermore, the method should not be used without placing some limitation on the minimum cement factor and the maximum water-cement ratio. Otherwise non-durable concrete may result in spite of a satisfactory initial strength. Cement is the binding medium in concrete and certainly there is some lower limit of the cement content below which we should not go if we are to expect durable construction. With respect to the water-cement ratio, research and experience both indicate that in concrete subject to severe weathering the water content should not exceed 6 gallons per sack of cement.

Durability of Aggregates

The durability of concrete is dependent on a number of factors and important among these is the soundness or durability of the aggregates used. The problem of developing some method of test that will be a definite measure of the durability of aggregates is still unsolved. It would appear that the sodium sulphate test, which is the one most commonly used for this purpose, should be a good measure of the ability of an aggregate to resist weathering, particularly frost action. In reality the test is not wholly satisfactory because of the difficulty of controlling important variables in the test procedure. The in-

ability of different laboratories to always check each other and the frequent inability of a single laboratory to check its own results have cast doubt on the reliability of the test and the significance of the results obtained. In view of these uncertainties the question is raised as to the test limits that should be adopted if the test is used, and even if it should be used at all as the basis for acceptance or rejection of aggregates. On the other hand we need a laboratory measure of durability and definite specification requirements. The majority of engineers are no longer satisfied with the indefinite and practically meaningless general clauses of the past. Aggregates of unquestioned soundness are required if concrete construction is to withstand the ravages of time.

Until some better measure of durability is developed it is believed that the use of the sodium sulphate test should be continued, but only as a warning of possible unsoundness. Provision should be made for the acceptance of aggregates failing to meet the test if a satisfactory service record for such aggregates can be established. Requirements of this character appear in the present Federal specifications. In this period of uncertainty the producers of aggregates can render valuable assistance in the production of good concrete by continuous and rigorous inspection of their own products and the elimination from shipment of any questionable materials disclosed by such inspection.

Los Angeles Abrasion Test

The Los Angeles abrasion test gives every evidence of being a much more satisfactory method for measuring the resistance of coarse aggregates to wear and impact than either the Deval abrasion test or the standard toughness test. The Los Angeles test, which takes its name from the city of its origin, has been used for a number of years by the Division of Highways of the California Department of Public Works and more recently has been adopted by a number of other State highway departments. It is now proposed for adoption as a standard method of test of the American Association of State Highway Officials.

This method of test, which is comparatively new from the standpoint of its general recognition, has the following advantages.

The equipment and procedure are simple and easily standardized and it is possible for different laboratories to check each other's work with a very satisfactory degree of accuracy. In a recent inves-

tigation by 18 cooperating laboratories 49 tests were made on a sample of crushed stone. The mean deviation from the average of all test results was only 5.6 per cent and the average results from only two laboratories deviated from the grand average by more than 10 per cent. In spite of the fact that not all the laboratories used identical equipment or followed exactly the same procedure this is a much better agreement between check tests than could be expected with the Deval abrasion test. In addition to its greater accuracy, the test requires much less time than does the Deval test.

The degree of angularity of the aggregate particles has very little influence on the results of the Los Angeles test. Approximately the same results are obtained with crushed stone and rounded gravel of comparable quality. Thus, in establishing the specification requirements for abrasion loss of coarse aggregates for a given purpose it should be possible to specify the same maximum loss for all materials regardless of type. This, of course, is a procedure which cannot be followed with the Deval test. On the other hand, the *shape* of particle does have a marked effect on the test results. Aggregates containing flat or elongated fragments in amounts usually considered objectionable show a much higher percentage of wear than do aggregates of similar quality composed of rounded or cubical particles.

In the case of rock the Los Angeles test is made on the crushed material as prepared for use in the work and may be made either before or after delivery of the material. This is not true of either the Deval abrasion test or the standard toughness test, both of which require the use of ledge rock that may not truly represent the crushed material subsequently furnished.

In the Los Angeles test the loss is produced largely by impact and thus may be expected to eliminate the need for the standard toughness test which has not proved to be entirely satisfactory. The toughness test has caused much trouble on account of its sensitiveness to variables that are difficult to control and the added fact that many rock materials are border-line products from the standpoint of the usual requirements for toughness. Defects in the testing apparatus, even though apparently slight, have often spelled the difference between acceptance or rejection of materials.

Finally, there appears to be a better agreement between test results and the behavior of aggregates in service than is the case with either the Deval test or the toughness test. As a result of the rather

limited study already made it is possible to establish tentatively a maximum abrasion loss of 40 per cent for aggregates that will be satisfactory in bituminous surface treatments. However, additional work must be done before we can be sure of the requirements that should be specified either for this type of road surface or for the other types of highway construction in which coarse aggregates are used.

The interest that has been shown in the Los Angeles abrasion test and the eagerness with which it is being accepted for study by many testing engineers is an indication of the widespread dissatisfaction with the older methods of test. The general abandonment of both the Deval test and the toughness test in favor of the Los Angeles test is anticipated and when this takes place we shall have made definite progress in the evaluation of aggregates for use in road construction.

Vibration of Concrete

One of the outstanding developments in construction during the past several years has been the introduction of high-frequency vibration as an aid in placing concrete. Internal vibrators are available with which remarkable results can be obtained in the placement of dry, harsh concrete in mass or reinforced structures. Surface vibrators, with which equally surprising results can be obtained, are available for use in the construction of concrete pavements and, more recently, vibratory equipment of the internal type has also been developed for this purpose.

Extensive investigations have been made, by the Bureau of Public Roads and other agencies, of surface-type vibrating finishing machines as compared with ordinary finishing machines. These have shown that vibration permits the use of a higher percentage of coarse aggregate and a lower water content than would otherwise be required and that it results in concrete of greater density than would otherwise be obtained. Advantage may be taken of the lower water content to obtain, with the same cement content, concrete of higher strength than can be obtained with standard finishing machines or, with a lower cement content, to obtain the same strength. The higher density which may be secured by vibration and the smaller amount of fine aggregate required may be expected to result in pavements having greater durability and less tendency to scale. In the casting of concrete in structures the use of the internal vibrator may be expected to show similar

advantages as compared with the ordinary methods of hand placement.

The merits of vibration as applied to pavement construction have been established beyond reasonable doubt and, moreover, the facts have been available for several years. In view of this it has been somewhat surprising that so little practical use has been made of the method. This may be due to conservatism in the adoption of new methods or to the cost of the necessary equipment and its operation. Whatever the cause, the advantages of vibration are so manifest that its general application to concrete pavement construction will not be delayed indefinitely.

Affinity of Aggregates for Asphalt

If an asphaltic paving mixture is to render satisfactory service it is required, among other things, that the asphaltic material shall thoroughly coat the particles of mineral aggregate and that this coating shall be of a permanent character. If the coating fails to adhere tenaciously to the particles of aggregate, disintegration of the pavement may be expected. It is a well known fact that some aggregates are unsuitable for use in asphaltic pavements, without some special treatment, due to their inability to be coated or to remain coated with films of the bituminous material. When asphaltic emulsions are used there may be failure to obtain a coating which is even apparently satisfactory, while other asphaltic mixtures that initially appear to be satisfactory may fail in service due to the gradual stripping of the asphalt films from the aggregate particles. It is reported that in extreme cases quarries have been practically abandoned on account of the fact that their products have been responsible for this type of failure.

The trouble, when trouble exists, is due to the fact that the rock material has a greater preference for water than for asphalt. This phenomenon has given rise to two terms that are rapidly coming into general use among asphalt technicians: "hydrophilic" to describe an aggregate that has a greater affinity for water than for bitumen and "hydrophobic" to describe an aggregate that has a greater affinity for bitumen than for water.

The importance of satisfactory adhesion between stone and asphalt and the disastrous results that may attend the use of hydrophilic aggregates have been known for many years but the general recognition of these facts is a comparatively recent develop-

ment. The subject is one that is increasingly engaging the attention of engineers concerned with asphaltic road construction. Numerous investigations of adhesion and the wetting properties of aggregates and bitumens have been made but much remains to be done. The studies of the past have merely indicated the possibilities of future research. The problem is primarily one of surface chemistry and its interest to the producers of aggregates lies in the possibility of developing means for changing the surface characteristics of aggregates that otherwise would be unsuitable for use.

Stone Sand

A discussion of this character would scarcely be complete without some mention of stone sand. However, the subject has been covered in detail elsewhere in the program of the convention. Therefore, it is sufficient here merely to state that there seems to be no reason why stone sand of suitable grading, manufactured from rock of unquestioned soundness, should not be a satisfactory fine aggregate for portland cement concrete. Here, again, the need for further investigation is indicated.

Soil Research and Stabilized Roads

And now we come to the most important development of recent years in the field of highway research. This is the really amazing progress that has been made in the study of soil materials with respect to their use in highway construction. Only a few years ago a knowledge of soils that was of any practical value to the highway engineer was virtually nonexistent. Now the value of soil science in its application to road construction is established. To the natural satisfaction of the research worker in giving new facts to the world is added, in this case, the gratification of having these facts accepted as being immediately useful.

Soil science, as applied to highways, is concerned with a diversity of subjects. For inclusion in this brief discussion, the subject of stabilized soil roads has been selected as being of the greatest immediate interest to the crushed stone industry.

Stabilized soil roads may be defined in a general way as road surfaces composed of fine-grained soils, either with or without mineral aggregates, in which sufficient strength has been provided, by any one of several methods, so that they can carry traffic at all seasons of the year without structural failure.

In the early days of the development of satisfactory soil-type roads, stabilization consisted in providing satisfactory strength by the proper combination of soil materials of suitable quality and grading with fine and coarse granular materials. Dr. C. M. Strahan of the University of Georgia was a pioneer investigator of the effect of the grading of materials, as determined by sieve analysis, on the performance of gravel, sand-clay and top-soil roads. While the name "stabilized roads" was not in use at that time, the roads studied by Dr. Strahan were actually of the stabilized type. As early as 1917 he recommended a grading for the best roads of this class and this ideal grading has not been changed essentially up to the present time. In 1922, long before the necessary tests had been developed, he suggested the need for determining the properties of the fine-grained binder material, pointing out that small amounts of highly colloidal clay might be expected to furnish adhesive strength equal to that furnished by greater amounts of less active material. The tests necessary for the purpose are now available and form the basis for the selection of binder materials for stabilized roads.

As the demand increased for greater mileages of low-cost roads, the use of deliquescent and water-retentive chemicals, such as calcium chloride and sodium chloride, was introduced as a valuable supplement in the construction and maintenance of those stabilized road mixtures that are dependent on proper grading. Also, for the stabilization of fine-grained or poorly graded soils there was introduced the use of water-insoluble binders such as asphaltic emulsions and, more recently, of other bituminous materials and portland cement.

Detailed discussion of stabilized roads of different types is to be given in other papers on this program and therefore may be dispensed with here. However, it is desired to indicate briefly the concern of the crushed stone industry in this subject and how it may be more greatly concerned in the future.

In stabilized roads of the graded type mineral aggregates are definitely required, while in roads stabilized with bituminous materials or portland cement it has been found that, even though aggregates may not be essential, their use is advantageous from the standpoint of economy. Here is a market for quarry products, particularly the finer materials that frequently are wasted, and the industry has an opportunity, if it so desires, to enlarge and extend this market.

The production of stabilized mixtures by any of the present methods is not a hit-or-miss procedure. There is required a knowledge of the soil tests and their use, and the proportions in which the materials should be combined. In addition, it is advantageous to secure a greater control of uniformity of proportioning and mixing than may always be attained by road-mix methods. This suggests plant production which already has been used with success by several State highway departments. The establishment by the aggregate producer of proportioning and mixing plants at convenient locations would provide a service welcome to many engineers and would do much to extend the use of stabilized mixtures to the smaller political units, such as towns and counties, where the requisite technical knowledge is not always readily available.

Conclusion

Highway research in general is concerned with a multitude of problems and many important developments, not mentioned here, have taken place in recent years. As has been stated previously, there have been included in this discussion only a few of the items which appear to be of most immediate interest to the crushed stone industry. In this limited field our inventory of accomplishments leads to the same conclusion as would a similar inventory in the broader general field. This conclusion is that the knowledge of highway materials and highway construction that we have acquired through research is insignificant when compared to the knowledge that remains to be acquired. And, as we make progress in one line of study, new and unexpected fields for future work open up before us. It has been said that highway construction is a continuing activity; that the end will never be reached. The same may be said of highway research.

Reprints of Whiting Williams' Paper Available

Events taking place since the Cincinnati Convention have given such added significance to the paper presented by Mr. Williams at that time entitled, "What's On the Worker's Mind Today?" that it has been deemed advisable to reprint his discussion in full text for immediate distribution to the membership. Additional copies can be obtained from the Washington Office at the nominal price of ten cents per copy.

Legal Aspects of the Silicosis Problem¹

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THE problem of silicosis should be of particular interest to the members of the National Crushed Stone Association. For the past several years industry generally has become "dust-conscious," and many lines of business have had to concern themselves with the legal responsibility created by the effect of dust upon the health of employees exposed to this hazard. We have heard and used many terms that are relatively new to most of us, such as "silicosis," "asbestosis," "siderosis," "anthrocosis," and other pneumoconioses, that have served to create new problems for those responsible for the operation of our great industrial processes.

The term "pneumoconiosis," of Greek origin, implies a condition of the lungs arising from the inhalation of excessive quantities of dust. Dust is possibly the oldest source of industrial hazard and has been a matter of concern to manufacturers for the past several centuries. Today, the medical profession and industrial scientists tell us of the risk of air-borne diseases and advise us that the pollution of the atmosphere by organic and inorganic dusts is the cause of ill health and premature mortality, chiefly among men and women engaged in trade. Our governmental agencies, federal and state, have been engaged in making surveys and studies in various industries to determine the effect of dust upon the health of workers engaged in these trades. These agencies, together with organizations of employers and employees, are giving more and more consideration to the problem of the effect of dust upon health, and are attempting to devise and perfect the ways and means to prevent and control dust diseases.

We are told that, to some extent, all dusts are harmful to human organisms, while certain dusts are actively dangerous. The dangerous dusts may be divided into three groups:

1. Poisonous dusts, such as lead, arsenic, etc.
2. Irritating dusts—those that irritate the respiratory tract, causing asthma, bronchitis, etc.
3. Dust producing pulmonary fibrosis, predisposing to respiratory infections, especially tuberculosis and pneumonia.

♦ During the course of the present calendar year, the legislatures of some forty states will be in session, with the probability that many will take some action with respect to compensation for silicosis injuries. It is the responsibility of affected industries to express their viewpoint concerning such legislative proposals to law-making bodies, if drastic and impractical laws are to be avoided. Mr. Waters has given this subject intensive and exhaustive study and his suggestions should be valuable in any consideration of silicosis legislation.

The latter class includes the dust known as "free silics," silicon dioxide, SiO_2 , which is the cause of the occupational disease, "silicosis."

When combined with other elements in the form of silicates, silica is comparatively innocuous, but when in its free state, it is perhaps the most dangerous of all dusts. When we recall that over sixty per cent of the earth's crust is composed of silica, we recognize that it is an element with which we come in daily contact. Its most common form is ordinary coarse sand. You and I breathe silica dust every day of our lives, we eat food containing silica, we have deposits of silica in our lungs. These deposits increase from day to day, and, in the course of a lifetime, the average person accumulates millions of particles of silica in his system. The mere exposure to silica dust, however, does not result in the contraction of silicosis. The dosage must be great and the exposure must be long. The only particles of dust that are dangerous are those of a size less than ten microns, a micron being $1/25,000$ of an inch. Even with a dust concentration of millions of particles per cubic foot of air, such dust may be almost invisible to the employee working in such an atmosphere. Medical scientists and industrial hygienists now advise industry that in those processes where the concentration of silica dust exceeds 5,000,000 particles of a size less than ten microns per cubic foot of air, a dust hazard exists and the workmen engaged in such processes may develop the disease of silicosis.

During the past year it has been my good fortune to serve as a member of one of the Committees of the National Conference on Silicosis, sponsored by the Secretary of Labor, and the reports of the various Committees of that Conference are now in the course of completion and will soon be published. From my own observation and contacts with the

¹ Presented at the Twentieth Annual Convention of the National Crushed Stone Association, at Cincinnati, Ohio, January 18-20, 1937.

members of the various Committees, I have come to the conclusion, which I believe to be correct, that the problem of silicosis in industry has been grossly exaggerated. By that statement I do not mean to minimize the seriousness of this occupational disease, nor do I mean to condone those industrial processes that create silicosis hazards, but I do believe that there is far less disabling silicosis in our industries than is popularly believed, and that many of the press reports with respect to this industrial problem have incorrectly portrayed the actual conditions that have existed in our industries.

Several years ago, a flood of common law suits spreading throughout the country caused extensive publicity, similarly exaggerated and grossly unfair to many manufacturers. That litigation, costly to all litigants, served the fortunate purpose of proving the inadequacy of common law procedure to adjust disputes between employer and employee, arising from this type of occupational disease injury, and, since then, we have seen numerous legislative attempts to provide some other means for the compensation of silicosis injuries.

At the present time, with the Legislatures of forty-three States to be in session during the present calendar year, and facing the probability that these Legislatures will take some action with respect to compensation for silicosis injuries, we recognize the importance of this subject to industry, employer and employee alike, and in considering this problem, it would be well to review briefly the legal relationship of employer and employee, and the liabilities imposed upon the employer for the protection of the health of his employees.

Common Law Liability of an Employer for Silicosis Injuries Sustained by an Employee

Prior to the adoption of the Workmen's Compensation Acts by our several State Legislatures, an employee injured in the course of his employment could only recover from his employer for those injuries that could be attributed to the negligence of his employer. The employer was not an insurer of the employee's safety and was not liable for the dangers of the employment, a risk assumed by the employee. The contributory negligence of the employee and the negligence of his own fellow servants were available as defenses to the employer. In cases involving industrial disputes, employees resorted to actions at common law and based their claims for compensation

upon the alleged negligence of the employer. This type of litigation proved to be unsatisfactory to both litigants. Such litigation was, of necessity, expensive, the employee retaining counsel upon a percentage basis, and paying for such legal services a substantial part of the jury's award; the employer, being subjected to jury trials, became the victim of increasingly large verdicts. To eliminate this procedure, the Workmen's Compensation Acts were designed and have served a very distinct and useful purpose in adjusting this type of dispute and insuring to the employee compensation for accidental injuries arising out of and in the course of his employment. While our Workmen's Compensation Laws are not perfect, either in their form or in their administration, I believe it is fair to say today that any attempt to effect their repeal would meet with the united resistance of both employee and employer.

The primary purpose of the authors of the Workmen's Compensation Acts was to make the remedy granted thereby the exclusive remedy for injuries suffered by employees during the course of their employment. They eliminated the employer's common law defenses and made the employers insurers of the safety of their employees for accidental injuries. These laws were originally designed to compensate solely for accidental injuries, that is, those occurring at a specific place, at a specific time, and which would be ascertained and determined coincidentally with the infliction of the injury. They did not purport to provide compensation for occupational diseases. The legal theory existed that the employee assumed the risk of his employment; he knew or should have known of the risk or danger from disease in the particular trade in which he was engaged. Today, however, we recognize the social need for compensation for occupational disease injuries just as well as for accidental injuries. On their part, employees are concerned primarily with the fact of their disablement. They are not interested in decisions that legally distinguish accidental injuries from diseases that are occupational. Therefore, we see the gradual imposition upon industry of new and heretofore un contemplated costs, including the obligation of insuring all employees against the hazards of the usual occurrences and exposures of their work. Our new social order tends to make employers insurers of the health of their employees and the legal and economic effect of such thought is a matter for serious concern.

I believe that industry is ready, willing and able to assume the burden of providing compensation for

those injuries occurring to employees as the result of the industrial processes in which the employees may be engaged and which are peculiar thereto. Certainly the honest employer desires to provide such compensation, and that cost should be borne by the particular industry wherein such injuries have been sustained, rather than by the public in the form of charity. On their part, honest employees desire compensation only when they have suffered actual injury and the practical difficulty is to devise ways and means of fairly determining occupational disease injuries, the extent of disability that arises therefrom, and providing adequate compensation for those that have suffered such misfortune.

The Legal Basis for Recovery for Silicosis Injuries in Common Law Actions

It will be interesting to consider the legal form of the cause of action and the type of testimony that is offered in support of the case of the plaintiff and the case of the defendant in the typical action involving this problem.

The usual form of declaration contains allegations that the defendant manufacturer caused the plaintiff to work in an atmosphere where silica dust existed; that the defendant knew or should have known that certain materials used by the defendant employer contained harmful or dangerous agencies of silica which were destructive to life and health in the human body; that the defendant was guilty of negligence in failing to warn the plaintiff of the danger and in failing to provide the plaintiff with a safe place in which to work or safe appliances with which to work; that thereby the silica became introduced into the plaintiff's lungs and body, causing him permanent injury. The defense pleadings set up the defense of assumption of risk by the plaintiff, the plaintiff's contributory negligence, the negligence of the plaintiff's fellow servants and a general denial of the allegations of negligence as charged by the plaintiff. Upon trial, the plaintiff and his co-workers testify as to the existence of clouds of dust in the working areas; of defective machinery, equipment and industrial processes; of the failure of the employer to warn employees of the dangers; of the failure of the employer to furnish efficient protective equipment such as masks; their industrial engineers expound their technical knowledge and beliefs. Doctors then describe the disease, its insidiousness, the total inability of nature and the medical profession to effect a cure, the prognosis of short life

for the plaintiff. The real basis of defense rests in the fact that the plaintiff has failed to prove negligence of the employer as charged in his pleading. In many cases competent medical defense can be offered and reputable doctors will contradict the testimony of the plaintiff's doctors.

It is needless for me to emphasize the seriousness of this type of litigation. Class is arrayed against class. The local press in those places where the cases are tried will carry sensational headlines with respect to the trial, describing the terror of the disease and emphasizing each detail of the complaint against the manufacturer. Suits are filed, not singly, but in dozens. The whole community wherein the industrial plant is located becomes aroused, with the attendant industrial chaos, and by the time the trial day arrives, every citizen of the community is so prejudiced against the defendant that it is almost impossible to procure an impartial trial.

The Need for Compensation Legislation

It will be readily seen that common law procedure is not a satisfactory method for the determination of claims for silicosis injuries. The ultimate solution of the problem of compensation for silicosis injuries must be found in legislation that will remove this dispute from our courts of common law. In the same way that Workmen's Compensation Acts eliminated such actions for accidental injuries, legislation must be devised to eliminate actions for occupational disease injuries.

Those who have given careful thought and study to the problem of compensation legislation for silicosis injuries have recognized the need of legislation separate and distinct from the mechanism of our compensation acts, with special legislative provisions to deal with many of the intricate problems that silicosis presents. Silicosis injuries differ materially from accidental injuries in that silicosis injuries are the result of the accumulation of injurious substances over an extended period of time in different forms or types of employment, and even under different employers, while accidents occur at a specific time, at a specific place, in a specific way, under a specific employer.

To attempt any detailed discussion of legislative provisions dealing with the problem of compensation for silicosis injuries would consume far more time than is allotted to me at this meeting. However, there are two phases of the problem that I desire to

discuss briefly, the first relating to compensation for partial disability, and the second relating to the function of medical testimony in the administration of silicosis compensation legislation.

1. *Partial Disability.*

In those States now considering legislation to provide compensation for silicosis injuries, industry is and should be concerned with provisions that would compensate partial disability. The basic theory of the Workmen's Compensation Acts has always been to provide compensation only for those injuries that disable an employee. Several of the leading members of the medical profession who have devoted extensive thought and research to the problem of silicosis injuries have recently advised me that an employee is only materially affected when infection accompanies silicosis and that, in the absence of infection, the employee is probably able to perform his duties relatively as well as prior to the time he suffered injuries arising from the inhalation of silica. I wish to stress the importance and the significance of this fact.

There are many employees today who show evidence of injury from the inhalation of silica who are not thereby disabled in any way or prevented from performing the particular duties that may be required of them. Assume, now, that legislation is enacted to provide payment for partial disability. Upon the effective date of that legislation, employees showing evidence of silicosis injuries would become entitled to compensation, regardless of their actual disability. You and I both know that the average commission administering compensation laws, in an effort to do justice to the injured employees, would probably award some disability benefits in cases where the medical diagnosis was uncomplicated silicosis. I believe that no substantial injustice would be done in denying compensation to claimants unless their silicosis was accompanied by infection. Such a method would accomplish the desired end in providing compensation only for actual disability, and would eliminate a substantial number of claims that might well harass and embarrass industry.

2. *Function of Medical Testimony in the Administration of Silicosis Compensation Legislation.*

One of the most perplexing problems that confronts the lawyer dealing with silicosis claims today is to obtain local medical advice with respect to the

merit of the employee's claim. There has been, and still is, great misconception and misinformation on the part of certain members of the medical profession with reference to this disease. At the present time I am concerned about the fact that there are not many doctors trained in industrial hygiene and experienced in the diagnosis of silicosis and the determination of disability resulting therefrom. In many of our large industrial States it is almost impossible to procure competent and reliable medical advice, with the result that upon the enactment of compensation legislation, employer and employee alike may be subjected to the determination of the medical issues presented by prospective claims by doctors totally unqualified to pass thereon. Many of the proposed silicosis acts make provision for medical boards or medical referees to advise the administrative agency upon the controverted medical issues presented in the course of hearings on claims. In view of the importance of such testimony, I have always believed that it would be better for each State to set up the mechanism for the creation of a medical board of three members, two of whom should be Roentgenologists, leaving to that board the determination of controverted medical issues and the appraisal of the claimant's disability.

On the Legal Subcommittee of the National Silicosis Conference, I advocated such a recommendation for our Committee and, to my disappointment, only two other members of our Committee of twelve entertained similar views. I believe that such a board, properly appointed, with the opportunity to give extensive time and study to the problem of silicosis in industry, will more efficiently and satisfactorily determine the medical issues of the claimant's case than some other agency, which has presented to it conflicting medical opinions. In other words, if three doctors in a State would be selected and appointed for extended terms, then by their very experience in the administration of the law, they would come to know and to recognize the intricacies of silicosis compensation in a way that would justify public respect for and acceptance of their decisions. If, on the other hand, each case presented to the administrative agency will bring in the testimony of new and perhaps unqualified doctors, I believe that the logical result will be confusion in the decisions of the administrators comparable to that such as we now have when juries attempt to determine similar questions.

The Necessity of Prevention

In closing, I wish to emphasize what to me seems to be the most important aspect of this problem, namely, prevention. From the standpoint of those who labor, they should be far more interested in the maintenance of their health in their particular employment than in compensation for injuries to that health. From the standpoint of employers, the cost of prevention of occupational disease injuries will be but a small fraction of the ultimate cost of compensation for such injuries.

With respect to silicosis, through agencies such as your own, the United States Public Health Service, and other State and industrial organizations in which industry may well have confidence, there is available, to you as employers, scientific information as to methods of eliminating most of the silica hazard that exists in your particular industries. If for none other than selfish reasons, you, as employers, should make use of this information. The initial cost may seem great, but it will many times repay the cost of compensation for silicosis injuries. I do not believe that modern society will countenance the continued failure of many industries to utilize such available methods of engineering control as will tend to minimize the hazard and I hope that in your industrial processes each of you here assembled will renew your interest and activities with respect to your own important departments of industrial hygiene. Labor, for its part, must discharge its duties with full appreciation of the hazards that are present in the particular industries wherein its members are engaged. There must be no half-hearted use of protective appliances with which labor may be supplied. Similarly, there must be no half-hearted enforcement of factory rules and regulations with respect to the use of such appliances. Again, there must be a coöperative observance of rules and regulations that may be laid down by safety engineers or State officials with respect to health conditions in your plants. The problem of health must become a major consideration by all interests involved and I honestly believe that with full coöperation of employer and employee, industry may be well on its way to elimination of this hazard and may relegate the problem of compensation for such injuries to statutory provisions such as the State may deem fit to adopt, reasonable in their provisions, but unnecessary to enforce because of the previous elimination of the hazard.

Needful Research in the Use of Aggregates

(Continued from page 16)

6. Railroad Ballast

As a member of the Committee on Railroad Ballast of the American Railway Engineering Association the speaker is kept in touch with the developments in that field. Much investigation work is still needed for the writing of proper specifications for railroad ballast. The Los Angeles Rattler Test which is creeping into highway specifications may also be a desirable test for railroad ballast. It already has been described before the membership of the A. R. E. A. When it becomes written into the specifications, the test limits imposed should be based upon facts. The development of these facts will involve laboratory tests on different crushed stones together with reports on their service behavior under different classes of railroad traffic. Your Association's laboratory should engage itself on work of this nature in order that, through the establishment of facts, the interests of crushed stone producers may be properly represented. Then, too, there are improvements possible in the construction of stone ballasted track. One of the difficulties encountered by maintenance men seems to be that there is a rapid filling of the voids in the stone by locomotive cinders. Some preliminary experiments conducted in our laboratory indicate that if it were possible to choke the surface voids of the ballast with small size stone much of this infiltration of cinders would be eliminated and, furthermore, there is the possibility of diverting a great deal of the surface water from immediate passage to the subgrade. Possibilities of very useful investigation work in connection with railroad ballast are open to us.

Conclusion

These are only a few of the problems confronting us. It will be impossible for us to engage ourselves on all of the problems which have been mentioned and we shall be forced to confine our efforts to those which appeal to us as most pressing. I think I have at least indicated to you some of the ways in which, through our engineering investigations, we can be of help to the crushed stone industry. We want your advice. You may have before you problems of an even more pressing nature which you would like to have solved. It is a pleasure for us to attempt to solve them for you and I want you to avail yourselves of our engineering facilities.

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